STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

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C.L. "Butch" Otter, Governor
John H. Tippets, Director

August 10, 2018

Timothy B. Hamlin, Director
Office of Air and Waste
Region 10, U.S. Environmental Protection Agency
1200 Sixth Avenue, Suite 155, OAW-150
Seattle, WA 98101-3123

Dear Mr. Hamlin:

The Idaho Department of Environmental Quality (DEQ) submits the enclosed documentation for data exclusion flagging and EPA concurrence as Exceptional Events for monitored values at the Pinehurst Idaho $PM_{2.5}$ and PM_{10} monitors. These monitors were affected by many wildfires in Idaho and surrounding states during the 2017 wildfire season. This documentation was prepared in accordance with requirements of the October 3, 2016 Final Rule, *Treatment of Data Influenced by Exceptional Events*, Federal Register Vol. 81, No. 191.

DEQ has flagged in AQS, the values shown in Table A of the attached documentation and their respective AQS/POC identifiers. As required, DEQ notified EPA of our intent to request exclusion of these dates on February 1, 2018 on a conference call.

A public comment period was held July 5, 2018 through August 6, 2018. Several written comments were received and the response to comments is included in Section 8. Complete documentation of the public comment process is also contained in Section 8.

Since these exclusion requests impact the clean data determination for the West Silver Valley $PM_{2.5}$ nonattainment area, DEQ would appreciate your review of the enclosed documentation and notification of EPA's determination of concurrence or non-concurrence to these flagged data as soon as possible.

If you have questions or need additional information please contact Mary Anderson at (208) 373-0202, or me at (208) 373-0552. Thank you for your attention to this matter.

Sincerely,

Tiffany Floyd
Administrator, Air Quality Division

Enclosure

cc: Gina Bonifacino, Acting EPA R10 Air Planning Unit Manager (no enclosure)
Justin Spenillo, EPA R10
Chris Hall, EPA R10

Exceptional Events Demonstration Requesting Exclusion of $PM_{2.5}$ and PM_{10} Monitor Values Impacted by Wildfires at Pinehurst, Idaho, in 2017

State of Idaho
Department of Environmental Quality

August 2018

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Abbreviations, Acronyms, and Symbols

§	section
$\mu g/m^3$	micrograms per cubic meter
AOD	aerosol optical depth
AQI	Air Quality Index
BSMP:	Best Smoke Management Practices
CRB	crop residue burning
CFR	Code of Federal Regulation
DEQ	Idaho Department of Environmental Quality
EER	Exceptional Events Rule
EPA	United States Environmental Protection Agency
EST	Eastern Standard Time
°F	degrees Fahrenheit
GeoMAC	Geospatial Multi-Agency Coordination Group
GIS	geographic information system
GOES	Geostationary Operational Environmental Satellite
HMS	hazard mapping system
HRRR	High Resolution Rapid Refresh
ID	Idaho
IDAPA	refers to citations of Idaho administrative rules
IDEA	Infusing satellite Data into Environmental Applications
kt	knots
LMP	limited maintenance plan
mb	millibars
MODIS	moderate-resolution imaging spectroradiometer
mph	miles per hour
MT	Montana
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
OR	Oregon
PBLH	planetary boundary layer height
PDT	Pacific Daylight Time
$PM_{2.5}$	particulate matter with a diameter of less than 2.5 micrometers
PM_{10}	particulate matter with a diameter of less than 10 micrometers
RWC	Residential Wood Combustion
US	United States
VIIRS	Visible Infrared Imaging Radiometer Suite
WA	Washington
WSV NAA	West Silver Valley $PM_{2.5}$ nonattainment area
Z	Zulu time (Universal Time Coordinated or UTC time)

Executive Summary

To address high monitor values resulting from exceptional events not reasonably controllable or preventable, the US Environmental Protection Agency (EPA) promulgated the Exceptional Events Rule (EER) pursuant to Section 319 of the Clean Air Act. Major changes to the 2007 EER contained in the Code of Federal Regulations (CFR), Title 40, Parts 50 and 51 (40 CFR 50 and 51) were promulgated on October 3, 2016 (72 FR 13560) to clarify the scope of the rules; analyses, content, and organization for exceptional events demonstrations; and fire related definitions and demonstration components. The EER allows states to *flag* air quality data as *exceptional* and exclude those data from use in determining compliance with the National Ambient Air Quality Standards (NAAQS) if EPA concurs with the state's demonstration that it satisfies the rule requirements.

Portions of Shoshone County, Idaho, were designated as the West Silver Valley $PM_{2.5}$[1] nonattainment area (WSV NAA) in 2015 (40 CFR 81), with an attainment date of December 31, 2021. However, on March 10, 2017, Idaho requested EPA make a Determination of Clean Data for the WSV NAA. EPA has not acted on this request. Monitor values during the 2017 wildfire season that meet the criteria for exceptional events must be excluded for the Clean Data Determination.

Following the EER procedures, the Idaho Department of Environmental Quality (DEQ) flagged values at the Pinehurst $PM_{2.5}$ and PM_{10}[2] monitors and is requesting concurrence that certain flagged values (Table A) are exceptional events. The $PM_{2.5}$ flagged values at or over 35 micrograms per cubic meter (µg/m^3) affect Idaho's compliance with the 24-hour NAAQS. The PM_{10} flagged values at or over 98 µg/m^3 affect Idaho's compliance with the 24-hour limited maintenance plan (LMP) criteria and NAAQS. DEQ demonstrates in this report and requests EPA concurrence that these exceptional concentration values occurred as a result of wildfires, they were not reasonably controllable or preventable by the State of Idaho, and they fully meet the EER criteria for excluding monitor values from the data used to determine compliance with NAAQS.

Table A. Monitor values for which DEQ is requesting EPA concurrence.

Date	24-hour average $PM_{2.5}$ (µg/m^3) AQS# 16-079-0017, POC 1	24-hour average PM_{10} (µg/m^3) AQS# 16-079-0017, POC 3
09/04/2017	144.9	—
09/05/2017	222.2	—
09/06/2017	147.1	169.6
09/07/2017	123.8	149.8
09/08/2017	116.7	143.7

An evaluation of the annual 3-year (2015–2017) $PM_{2.5}$ design value for the Pinehurst monitor with and without the requested exceptional event days shows that three days (9/5/17, 9/6/17, and

[1] Atmospheric particulate matter (PM) with aan aerodynamic diameter of 2.5 micrometers or less.
[2] Atmospheric particulate matter with a n aerodynamic diameter of 10 micrometers or less.

9/4/17) require removal from the dataset to lower the design value below 12.0 µg/m^3 (Table B). Two additional days (9/7/17 and 9/8/17) are requested to achieve a buffer of 0.3 µg/m^3 below the NAAQS for future consideration.

Table B. Evaluation showing change in annual $PM_{2.5}$ design value with exceptional event data removed.

24-hour average $PM_{2.5}$ (µg/m^3)	Date	Resulting design value if value removed from dataset (µg/m^3)
3-year (2015–2017) design value with all 2017 days		12.4
222.2	09/05/2017	12.2
147.1	09/06/2017	12.1
144.9	09/04/2017	11.9
123.8	09/07/2017	11.8
116.7	09/08/2017	11.7

An evaluation of the 24-hour 3-year (2015–2017) PM_{10} design value for the Pinehurst monitors with and without the requested exceptional event days shows that one day (9/6/17) requires removal from the dataset to lower the design value below 1.0 expected exceedances (Table C). Two additional days (9/7/17 and 9/8/17) are requested to maintain compliance with the 24-hour LMP criteria.

Table C. Evaluation showing change in 24-hour PM_{10} design value with exceptional event data removed.

24-hour average PM_{10} (µg/m^3)	Date	Resulting design value if value removed from dataset (expected # of exceedances)
3-year (2015–2017) design value with all 2017 days		1.0
169.6	09/06/2017	0.7
149.8	09/07/2017	0.7
143.7	09/08/2017	0.7

Required Elements of the Exceptional Events Rule

The EER requires that demonstrations justifying data exclusion as exceptional events must include the following:

> (a) a narrative conceptual model that describes the event(s) causing the exceedance or violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s);
>
> (b) a demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation;
>
> (c) analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times to support the clear causal relationship requirement;

> (d) a demonstration that the event was both not reasonably controllable and not reasonably preventable;
>
> (e) a demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event; and
>
> (f) documentation that the State followed the public comment process and conducted at least a 30-day comment period.

In addition, the state must submit the public comments with the demonstration and address in the demonstration those comments disputing or contradicting factual evidence provided in the demonstration (40 CFR 50.14).

This demonstration is organized by sections that address each element of the EER (Table D).

Table D. Summary of EER elements included in the demonstration.

EER Element	Section	Summary
Conceptual Model	1	The conceptual model describes the source of the event and affected region and summarizes the weather system and transport flow that brought smoke from wildfires to the Pinehurst monitor. Data describing wildfire emissions and monitor impacts are provided.
Clear Causal Relationship	2	Data are presented to demonstrate that the event affected air quality in such a way that there exists a clear causal relationship between the event and the exceedances: 1) Meteorological Evidence: Transport of Emissions to Monitor 2) Satellite and Back Trajectory Evidence: Spatial Relationship between Source and Monitor 3) Time Series Evidence: Temporal Description of Event Day 4) Alternative Sources
Historical Concentrations	3	Analyses are provided comparing the event-influenced concentrations at Pinehurst to historical concentrations.
Not Reasonably Controllable or Preventable	4	A wildfire event meets the EER for this element (40 CFR 50.14(b)(4))[3].
Human Activity Unlikely to Recur at a Particular Location or a Natural Event	5	The criterion meets the EER definition that wildfires predominantly occurring on wildland are natural events.
Mitigation	6	DEQ presents evidence of prompt public notification of the event, public education so that individuals could make behavioral changes to reduce exposure to unhealthy air, and implementation of appropriate measures to protect public health from the impacts of exceptional events.
Initial Notification	7	Demonstration of initial notification to EPA.
Public Comments	8	Documentation of the public comment process, public comments received and DEQ response to comments.

[3] 40 CFR 50.14(b)(4): "Provided the Administrator determines that there is no compelling evidence to the contrary in the record, the Administrator will determine every wildfire occurring predominantly on wildland to have met the requirements identified in paragraph (c)(3)(iv)(D) of this section regarding the not reasonably controllable or preventable criterion."

Introduction

The Idaho Department of Environmental Quality (DEQ) requests exclusion of five measured exceedances of the 24-hour $PM_{2.5}$ (particulate matter with a diameter of less than 2.5 micrometers) National Ambient Air Quality Standards (NAAQS) at Pinehurst, Idaho, on September 4, 5, 6, 7, and 8, 2017. DEQ also requests exclusion of three measured values above the 24-hour PM_{10} limited maintenance plan (LMP) criteria (particulate matter with a diameter of less than 10 micrometers) NAAQS at Pinehurst, Idaho, on September 6, 7, and 8, 2017. This demonstration provides evidence and narrative satisfying all the requirements set forth in the Exceptional Events Rule (EER). The exceedances were the direct result of a wildfire event that affected air quality at the Pinehurst monitor. The conceptual model describes the event and how the emissions from the event led to the exceedances at the Pinehurst monitor. It demonstrates that a clear causal relationship exists between the event and the monitored exceedance. Historical concentrations at the Pinehurst monitor are compared to the exceedance concentrations to support the clear causal relationship requirement. The wildfire event was both not reasonably controllable and not reasonably preventable, and it was a natural event. DEQ provided prompt public notification of the event, provided for public education concerning actions that individuals may take to reduce exposures to unhealthy levels of air quality during the event, and provided for the implementation of appropriate measures to protect public health from the exceedances caused by the event. Public comments on the demonstration and DEQ's responses will be included at the end of the document following the public comment period.

1 Conceptual Model

In early September 2017, smoke from regional wildfires was transported to the Pinehurst monitor. A strong mid-level ridge caused the atmosphere to stagnate, keeping the smoke in place for five days. The Pinehurst monitor recorded exceedances of the 24-hour $PM_{2.5}$ NAAQS on September 4, 5, 6, 7, and 8, 2017, as a result of this event. On September 6, 7, and 8, 2017, high PM_{10} values were recorded at the Pinehurst monitor as well. The conceptual model describes the source of the particulate matter that impacted the monitor, the transport weather conditions that brought the aerosols to the monitor, the estimated emissions of the wildfire sources, and the timing and magnitude of the event's impact on the monitor.

1.1 Overview

Wildfires occur every year in the western United States during summer and fall. The 2017 wildfire season was, like most years, hot, dry, and smoky. Over 1.8 million acres burned in Idaho (ID), Washington (WA), and Oregon (OR) (Table 1) (NIFC 2017a). More than 1.3 million acres burned in Montana (MT), and an additional 3 million acres burned in the Canadian provinces of British Columbia and Alberta (Government of British Columbia 2017; CIFFC 2017). During the first full week of September, smoke from many of these fires was trapped in a multiday stagnation event driven by a strong mid-level ridge pattern. Smoke accumulated during a 5-day period and negatively affected the air quality throughout the northwestern United States. The air quality monitor at Pinehurst, Idaho, recorded daily $PM_{2.5}$ concentrations above the 24-hour

NAAQS on September 4, 5, 6, 7, and 8, 2017, and PM_{10} concentrations above the 24-hour LMP criteria on September 6, 7, and 8, 2017.

Table 1. Wildfire acres burned in 2017.

State/Province	Acres Burned in 2017
Washington	404,223
Oregon	714,520
Idaho	686,262
Montana	1,366,498
British Columbia, Canada	>2,965,265
Alberta, Canada	118,786

1.2 Transport Weather Conditions

During September 4–8, 2017, Idaho was under a strong mid-level ridge pattern that trapped smoke produced by and transported from multiple wildfires burning throughout the Pacific Northwest. The weather pattern affected the entire Pacific Northwest but was strongest over north central Washington and the Idaho Panhandle.

The weather system transported smoke from wildfires to the Pinehurst monitor and then trapped the smoke in place for several days. A mid-level ridge is known for its stagnant atmospheric characteristics due to limited transport and surface wind speeds, low mixing heights, and capped thermally driven convection due to subsidence (Whiteman 2000). Convective motion is limited, suppressing vertical mixing and typical diurnal mixing available to move smoke. A negative feedback can also occur with reduced solar radiation reaching the surface due to the opacity of smoke, further limiting the convective influences on vertical mixing. Horizontal movement is limited due to the light surface and transport winds, which further limit the range of dispersion for smoke. The winds at 20,000 feet were less than 5 knots (kt) from September 4–8 (Figure 1), which supports the lack of strong transport winds. Any smoke that was present would remain. Any transport that did occur would be from the northwest, where most of the fires were burning. Additionally, this stagnation allows for low-level complex mountain-valley wind patterns to become the driving force. Nocturnal drainage winds become the primary source of horizontal motion under this scenario.

Figure 1A–E shows the progression of the ridge pattern at the 500 millibar (mb) level. The ridge pattern established on September 3 built in strength on September 4. The ridge was strongest on September 5, with height contours indicating a local high pressure of 594 dekameters centered over eastern Oregon. September 6 and 7 were similar, with the ridge remaining in place and the local high parked over the tristate boundary. By September 8, the ridge began to break as a low pressure system approached the northern California coast. This system led to increased mixing heights and stronger surface and transport winds from the southwest, which helped clear smoke out of the southern part of the region.

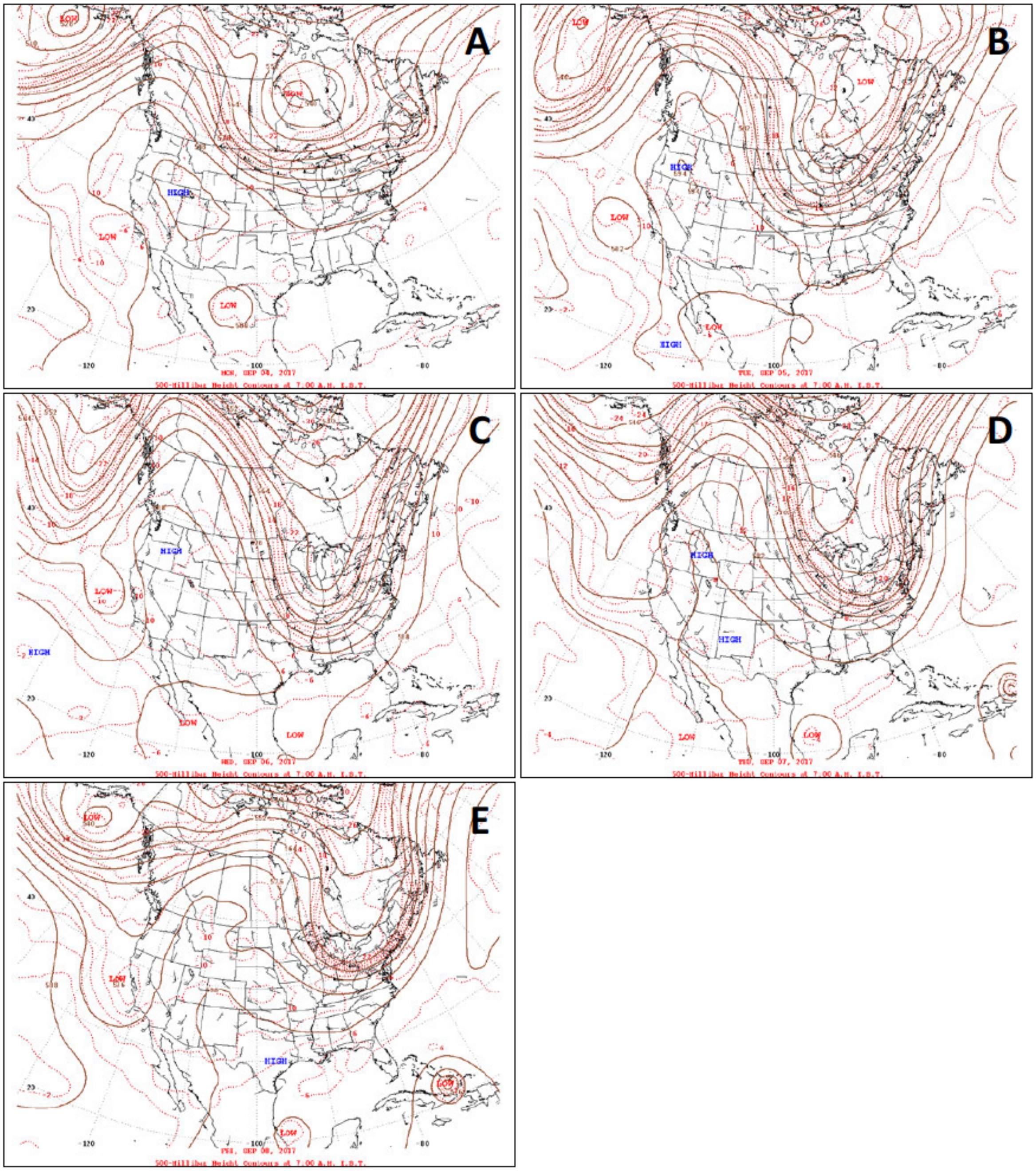


Figure 1. September 4–8, 2017, 500 mb height contours over North America showing daily progression of mid-level ridge over the Pacific Northwest: A) September 4, B) September 5, C) September 6, D) September 7, E) September 8 (NOAA 2017).

The strong ridge, in addition to dry conditions at the beginning of September, caused rapid fire growth that led to increased smoke production. The stagnant atmosphere trapped the smoke, and more accumulated each day the ridge was in place.

1.3 Source Area and Affected Region

The smoke originated from fires mapped in Figure 2. Each red dot represents a fire heat signature detected by satellite between September 4 and 8. Many fires were burning throughout the region, from large, scattered complexes in British Columbia to multiple conflagrations delineating the north-south spine of the Cascade Range. Many wilderness fires burned throughout the Bitterroot Mountains in Idaho, and large fires clustered in the northern Rocky Mountains in Montana.

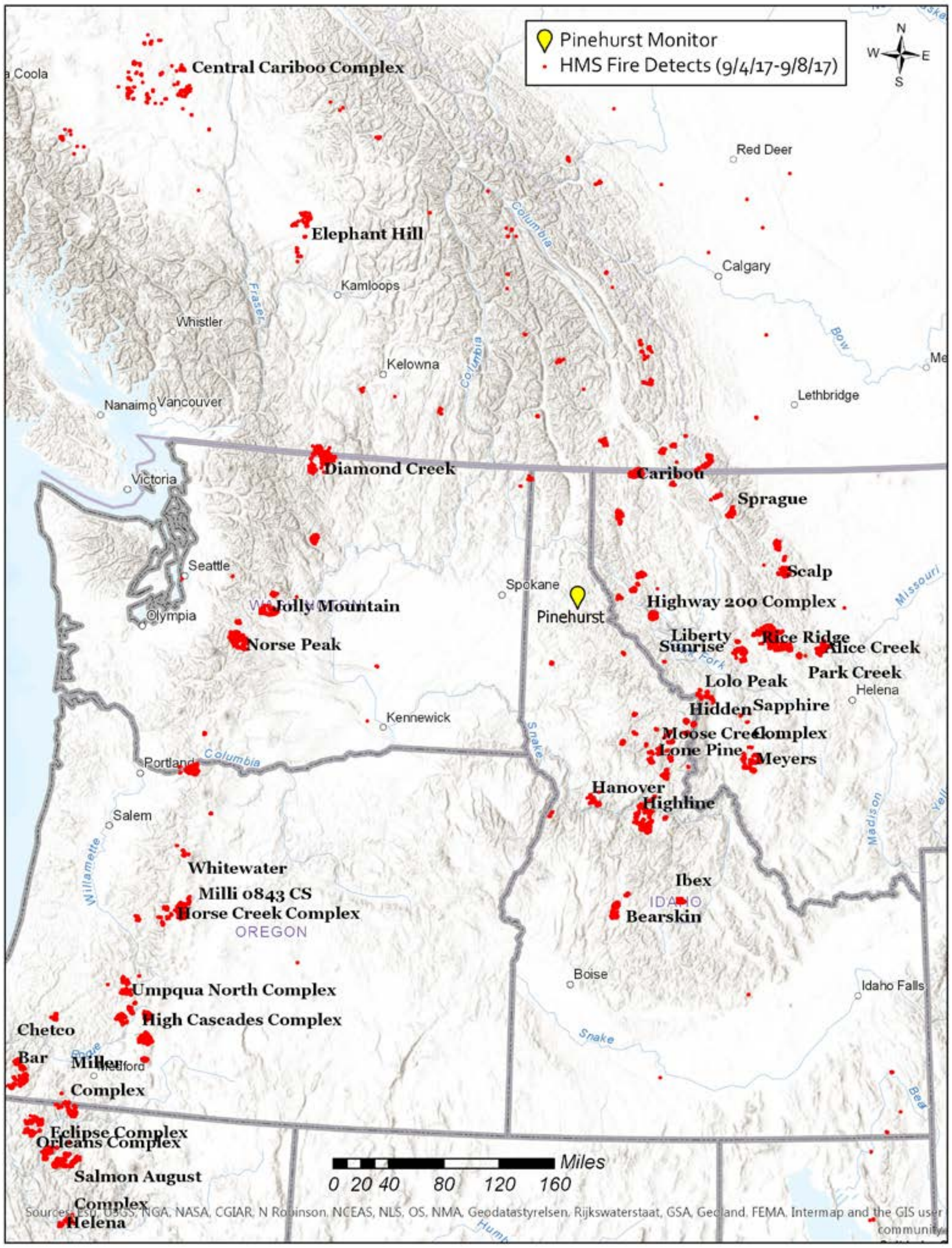


Figure 2. Fires active in the northwest during the episode, September 4–8, 2017. Significant fires and the Pinehurst monitor are labeled (NIFC 2017b; USFS 2018; Government of British Columbia 2017).

The presence and movement of smoke during the episode is illustrated in a series of true color satellite photos (Figure 3). On the first day of the episode, September 4, thick smoke occupied the border region between northern Idaho and western Montana and along the Oregon Cascades and coast. A plume of moderate density smoke extended across the Oregon-Washington border and southeast into southern Idaho. On September 5, heavy smoke obscured the surface features of Washington, coastal Oregon, and western Idaho, from the Canadian border south to Boise. A swath of smoke occupied the Snake River Plain in southern Idaho, and a separate plume stretched east from Idaho Falls into Wyoming. On September 6, all three Pacific Northwest states were covered with thick smoke, as was western Montana. The image of September 7 shows a general thinning of the smoky pall in southern Idaho as geographical features emerged into view. Clouds had formed in the southern part of Oregon as a southwest wind pushed the smoke northeast. On the final day of the episode, September 8, smoke remained in eastern Washington, northern Idaho, and in western Montana.

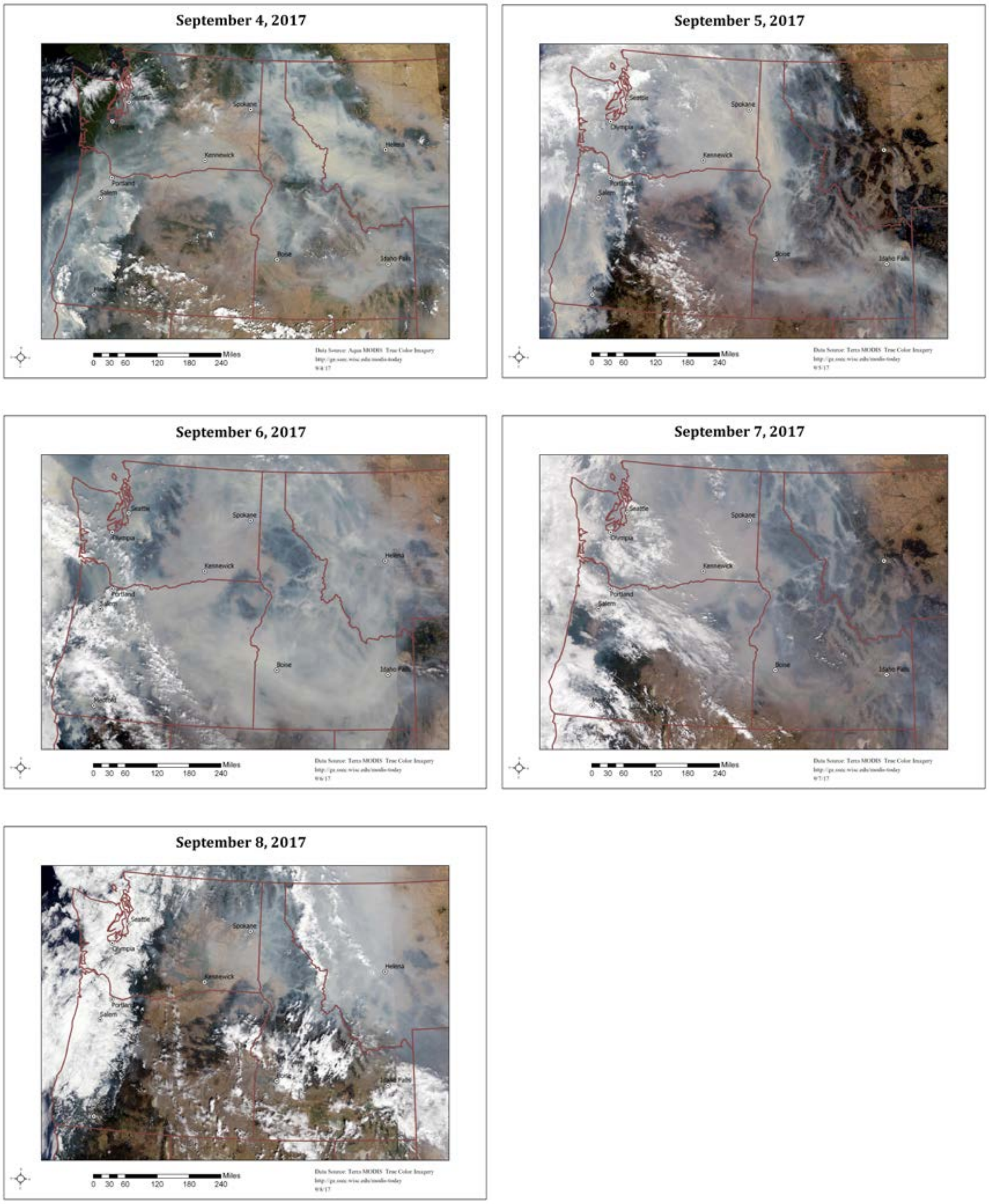


Figure 3. Moderate-resolution imaging spectroradiometer (MODIS) Terra (~11 am local time) and Aqua (~2 pm local time) satellite images of the Pacific Northwest during the September 2017 episode (NASA 2018b).

Aerosol Optical Depth (AOD) is an index of atmospheric aerosol content derived from satellite surface reflectance data. It can be used to quantify the smoke density visible in the true color satellite images. Figure 4 (A–E) plots Visible Infrared Imaging Radiometer Suite (VIIRS) AOD during each day of the episode. The figures are a spatial time series of smoke extent and thickness during the period. The dark red areas indicate AOD = 1.0 on the index. An optical thickness of less than 0.1 indicates a clean atmosphere with excellent visibility; a value of 1.0 represents an aerosol density thick enough to obscure the sun at midday (NASA 2018a). Black areas denote clouds or extremely thick smoke that the algorithm misidentified as clouds. Inspecting the true color imagery on the same day clarifies whether it is cloud or smoke.

Figure 4A (September 4) shows thick smoke across much of the tristate area. On September 5 (Figure 4B), high density smoke covered the Pinehurst area and the rest of the three states except for central Oregon. September 6 (Figure 4C) exhibits AOD values of 1.0 in all areas of the Pacific Northwest. On September 7 (Figure 4D), a southwest wind began pushing the aerosols northeast, illustrated by the lower AOD values in southwestern Oregon. Figure 4E (September 8) shows extensive clearing in southern Idaho, Oregon, and western Washington as the mid-level ridge fully broke and a trough moved in. Northern Idaho and Pinehurst retained high AOD values on the final episode day.

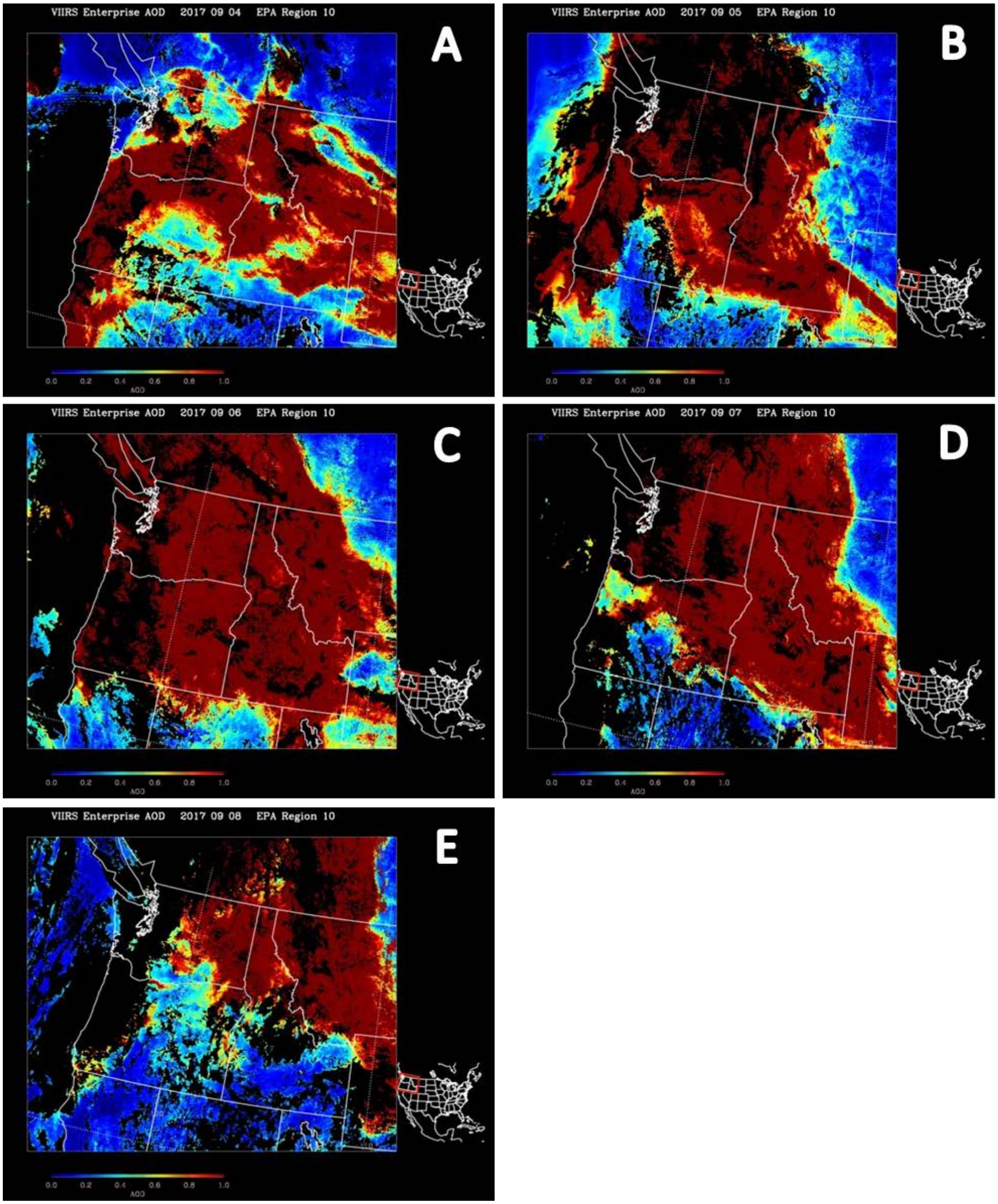


Figure 4. VIIRS Aerosol Optical Depth index values of smoke aerosols in the Pacific Northwest atmosphere during the September 2017 episode: A) September 4, B) September 5, C) September 6, D) September 7, E) September 8 (IDEA 2017). The VIIRS satellite makes daily passes at ~2 pm local time.

1.4 Emissions

Sections 1.2 and 1.3 demonstrate that heavy smoke from regional wildfires impacted the Pinehurst monitor on September 4, 5, 6, 7, and 8, 2017. Some of the smoke originated from outside Idaho's borders and some from within. To put into perspective how much $PM_{2.5}$ the wildfires produced, it is instructive to compare the 2017 wildfire emissions to normal annual $PM_{2.5}$ emissions from other sources (Figure 5). Wildfire emissions for Idaho were calculated from the Geospatial Multi-Agency Coordination Group (GeoMAC) wildland fire perimeters for 2017 (as of October 16, 2017) and from the latest methods and emissions factors available in the scientific literature (Herron-Thorpe 2017; Larkin et al. 2009; Lincoln et al. 2014; Urbanski 2014; Prichard et al. 2013; GeoMAC 2018). Other Idaho emissions sectors were obtained from the 2014 National Emissions Inventory (NEI), version 1 (EPA 2016). DEQ determined that the 2014 NEI was the best and most recent representation of non-wildfire emissions. Idaho wildfires produced an estimated 111,255 tons of $PM_{2.5}$ in 2017. The next closest category, nonpoint sources, produces 65,383 tons of $PM_{2.5}$ during a typical year. Prescribed fires produce the next highest amount of $PM_{2.5}$ at 19,223 tons per year. Idaho wildfires produced more $PM_{2.5}$ in 2017 than all other anthropogenic source categories in a typical year. In addition, a large amount of wildfire smoke advected into Idaho from neighboring states and provinces.

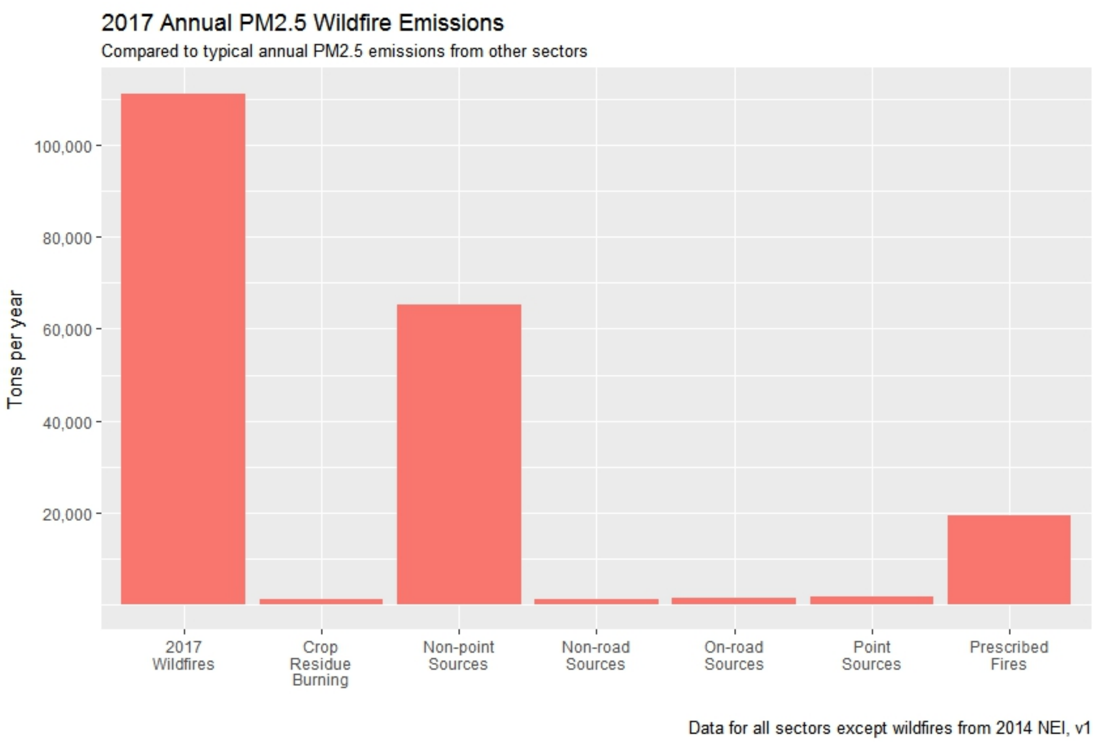


Figure 5. Idaho annual $PM_{2.5}$ wildfire emissions for 2017 compared to annual $PM_{2.5}$ emissions for other source categories from the 2014 National Emission Inventory (EPA 2016).

To further quantify the regional $PM_{2.5}$ emissions during the event period, an area of influence was selected that contained source wildfires that likely impacted the monitor (Figure 6).

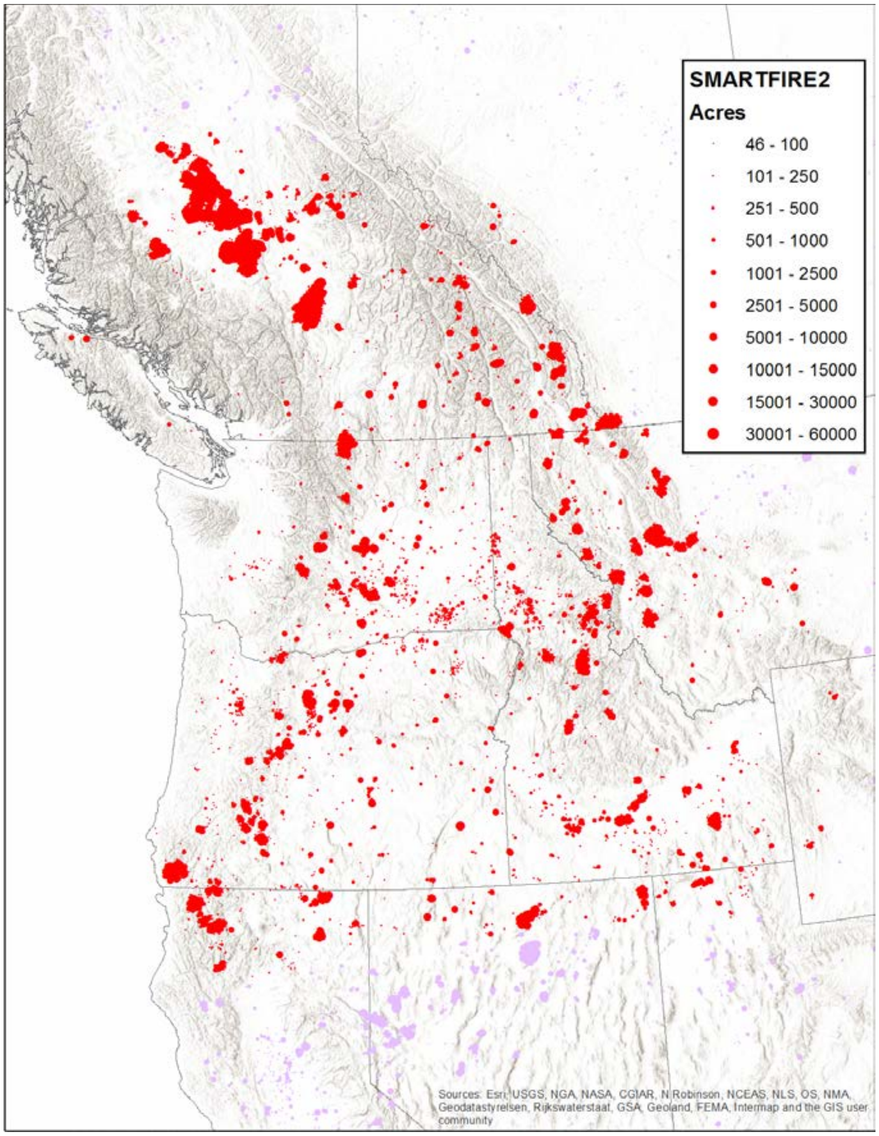


Figure 6. Area of influence containing fires that contributed $PM_{2.5}$ emissions during the 2017 wildfire season (6/1/17-9/30/17). Red dots indicate fire size by acre within the area of influence. Lilac dots are fires outside the selected area of influence.

Daily acres burned were obtained by running SMARTFIRE v2 (Herron-Thorpe, 2018). A 5-day running mean was calculated on the daily acres burned (Figure 7). A large increase in acres burned noticeably corresponds with the September episode time period, from 8/28/17 to 9/10/17.

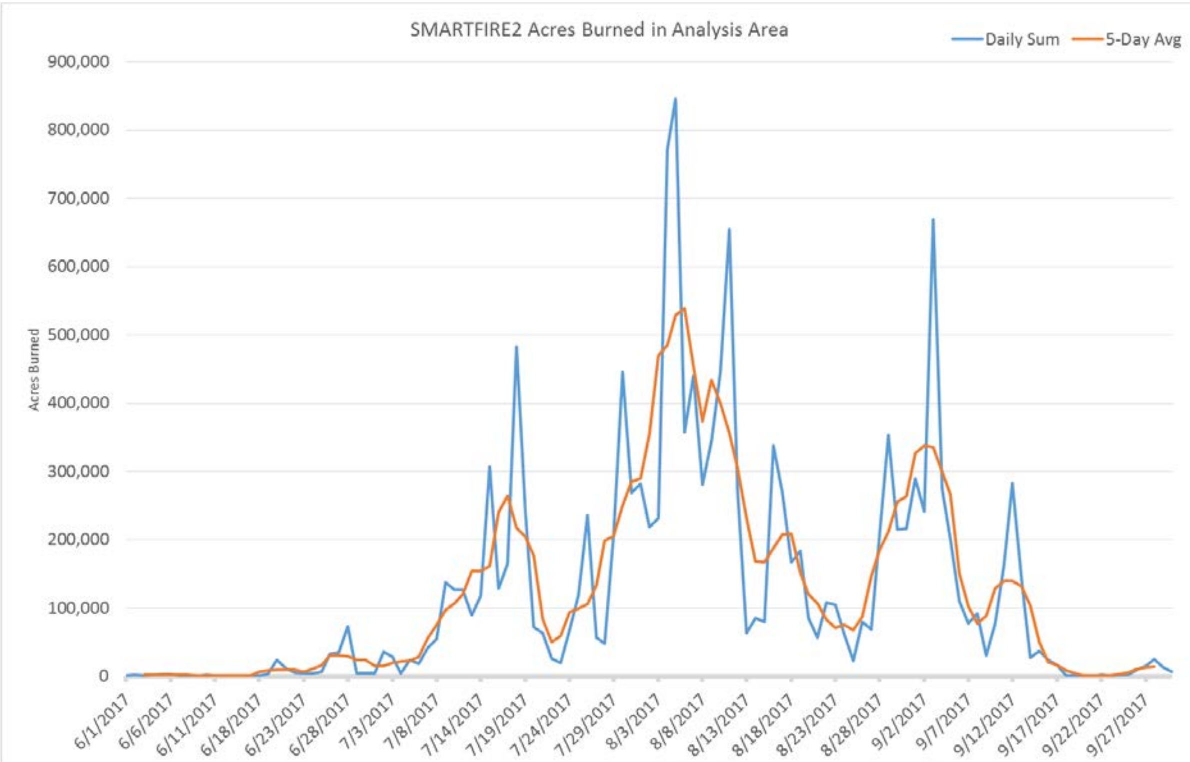


Figure 7. Daily acres burned by wildfires and prescribed burns during the 2017 wildfire season.

Daily fire emissions were estimated using BlueSky v3.5.1 for the event period plus the preceding day, 9/3/17, for WA, OR, ID, and MT (Figure 8). Other emissions categories were obtained from monthly AIRPACT5 emissions summaries produced by the SMKREPORT option in the SMOKE model (*http://download.aeolus.wsu.edu:3838/emissions_summary/*). It is clear that $PM_{2.5}$ emissions from fires far outstrip $PM_{2.5}$ emissions from all other categories during the event period. $PM_{2.5}$ emissions from fires account for 99.4% of all $PM_{2.5}$ emissions from 9/3/17 to 9/18/17. Anthropogenic sources account for 0.6%. Also notable is the large surge in fire emissions that occurred on September 3, 2017. These emissions were subsequently trapped in the high pressure weather system and remained in the region until the end of the event. DEQ asserts that $PM_{2.5}$ due to fire emitted just preceding and during the event was sufficient to create the impact on the monitor that was recorded on September 4, 5, 6, 7, and 8.

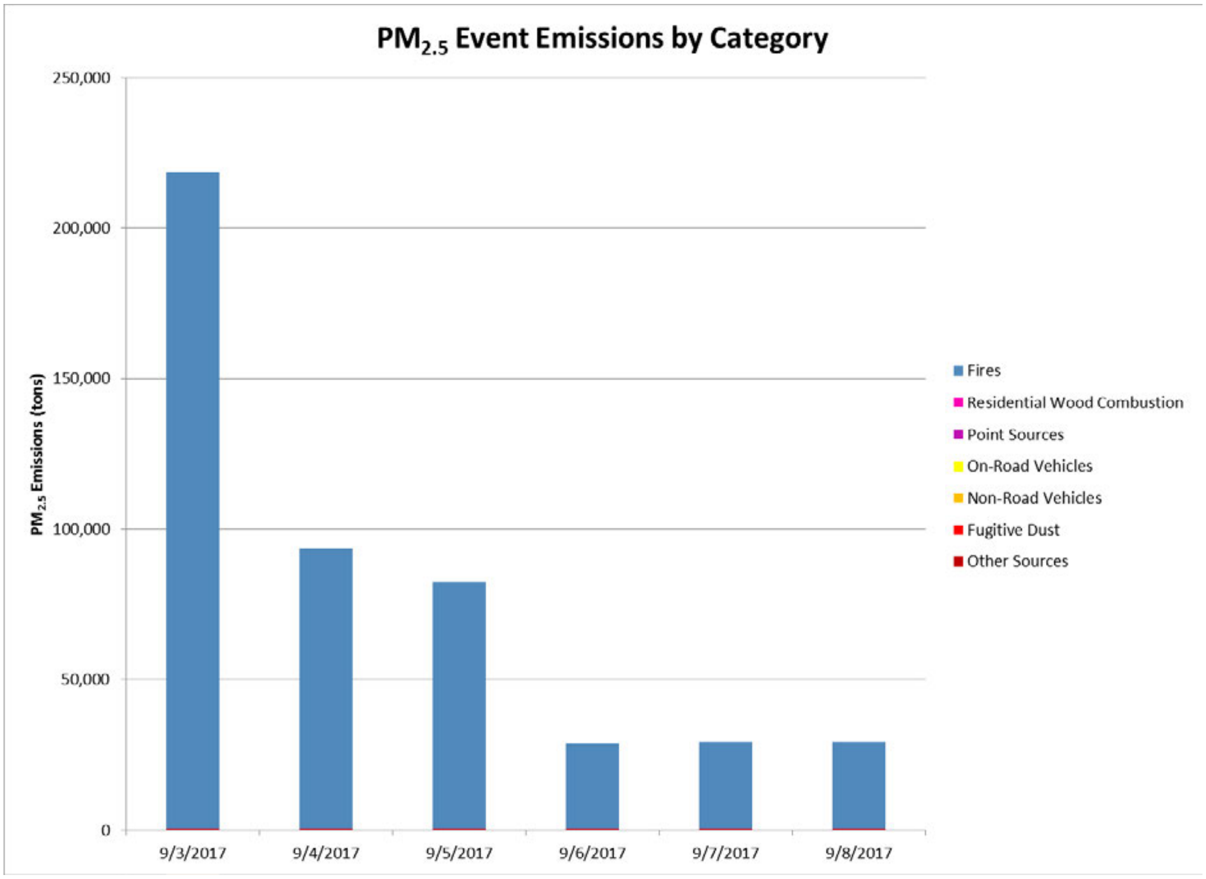


Figure 8. $PM_{2.5}$ emissions during event period for WA, OR, ID, and MT.

1.5 Monitor Impact

The widespread nature of the September episode is reflected in the spatially extensive air quality impacts on Idaho monitors. All 30 $PM_{2.5}$ monitors in the Idaho network recorded daily Air Quality Index (AQI) values at or above the Unhealthy for Sensitive Groups category for multiple days (Figure 9). Many monitors were in the Unhealthy and Very Unhealthy categories for two or more days. If the source of the event was local to the Pinehurst monitor, then only that monitor would have had exceedances. However, since this was a regional event, all monitors in Idaho were impacted simultaneously.

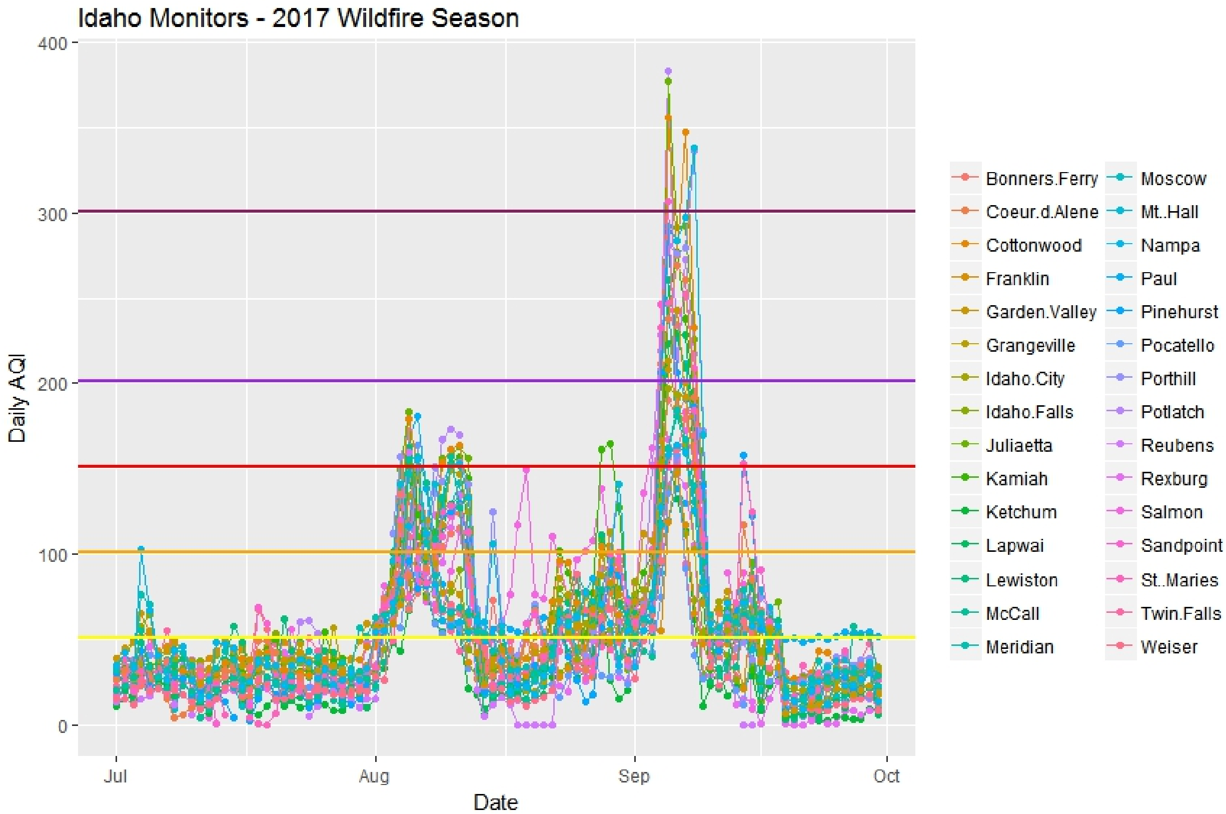


Figure 9. Daily AQI values for all Idaho monitors during the 2017 wildfire season.

$PM_{2.5}$ concentrations at the Pinehurst monitor rose rapidly starting at 10 a.m. Pacific Daylight Time (PDT) on September 5 and remained above 100 micrograms per cubic meter ($\mu g/m^3$) for the remainder of the episode (Figure 10). Peak values occurred on September 4 and 5, reaching 350 $\mu g/m^3$ and above. When averaged, the concentrations exceeded the 24-hour NAAQS for September 4, 5, 6, 7, and 8, 2017.

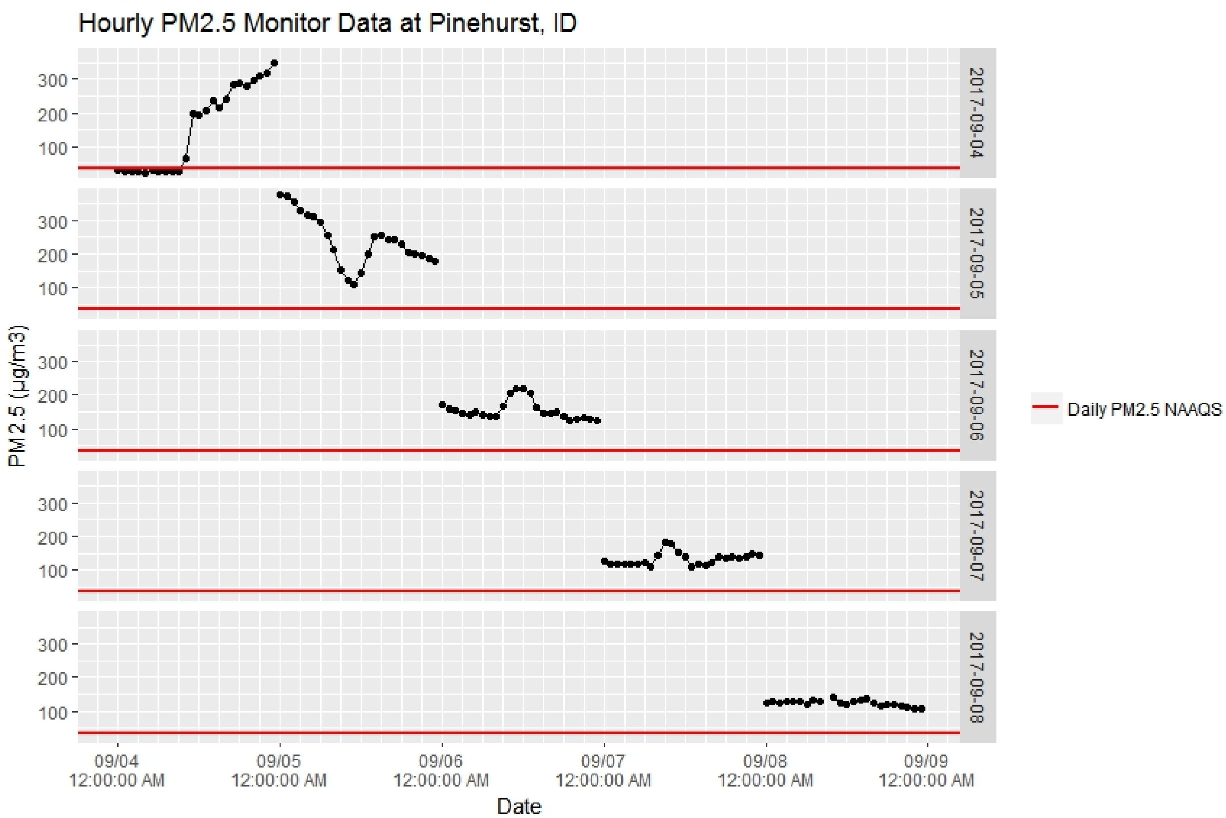


Figure 10. Time series of hourly $PM_{2.5}$ concentrations at Pinehurst monitor from September 4 through September 8, 2017.

PM_{10} concentrations at the Pinehurst monitor were above the 24-hour NAAQS for much of the day on September 6 and peaked above 230 µg/m^3 (Figure 11). On September 7, concentrations spiked in the morning and afternoon, remaining above 98 µg/m^3 (the 24-hour LMP criterion) during the rest of the day. PM_{10} concentrations on September 8 held steady in a range between 120 and 160 µg/m^3.

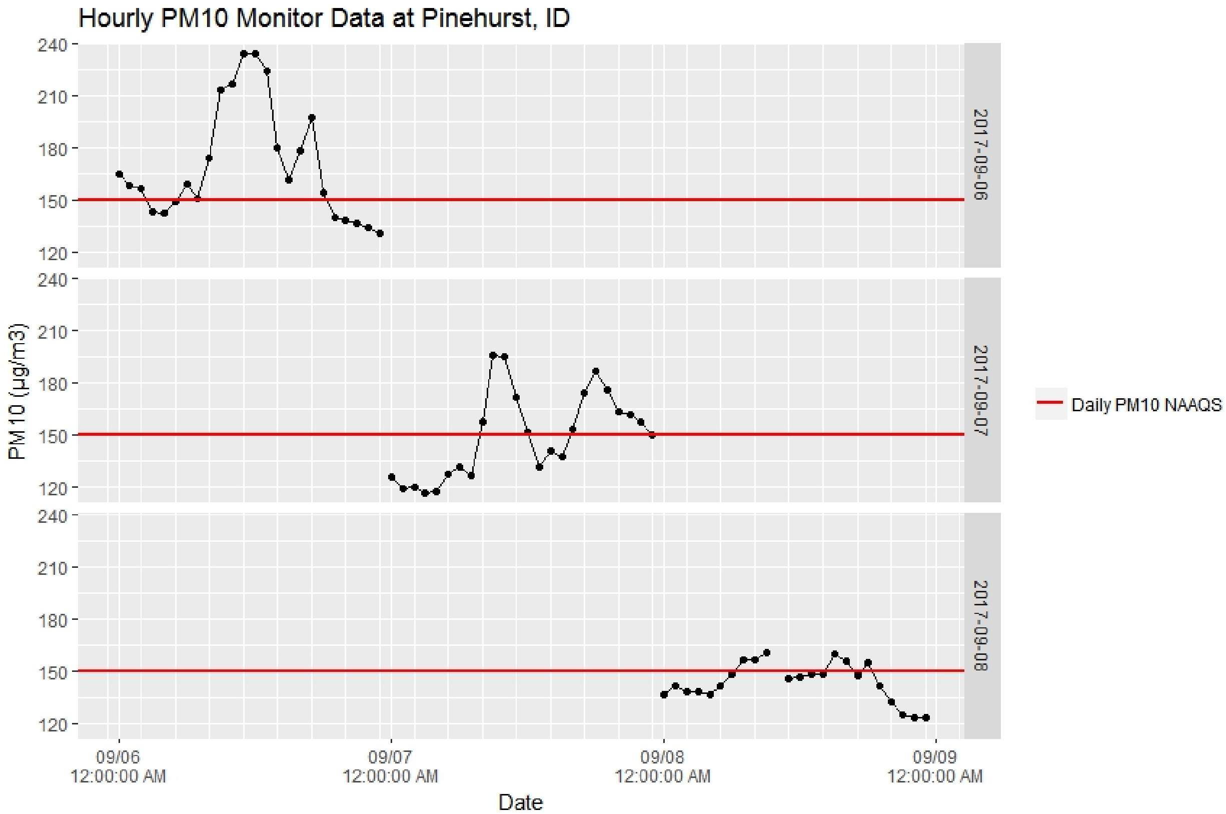


Figure 11. Time series of hourly PM_{10} concentrations at Pinehurst monitor from September 6 through September 8, 2017.

1.6 Summary

In early September 2017, Idaho was impacted by an extended event that caused regional wildfire smoke to be transported to the Pinehurst air quality monitor. A strong mid-level ridge trapped the smoke in place and allowed it to accumulate. Particulate matter produced by numerous wildfires burning throughout the Pacific Northwest impacted the Pinehurst $PM_{2.5}$ and PM_{10} monitors, causing exceedances of the 24-hr $PM_{2.5}$ NAAQS on September 4-8, 2017; exceedance of the annual $PM_{2.5}$ NAAQS; and exceedances of the 24-hr LMP criterion and 24-hr NAAQS for PM_{10} on September 6-8, 2017. DEQ contends that this episode constitutes an exceptional event and requests that the US Environmental Protection Agency (EPA) exclude the data from use in determining exceedances and violations.

2 Clear Causal Relationship

A clear causal relationship between a source and monitor is demonstrated with multiple strands of evidence linking the source of the event to the monitored exceedance. DEQ provides a concise description of how the evidence for each day demonstrates the clear causal relationship. In addition, alternative sources of $PM_{2.5}$ and PM_{10} are explored.

2.1 Sources of Evidence

For each event day, evidence demonstrates the existence of a clear causal relationship between the event and the monitored exceedance. The origins and preparation of each evidence category are described below.

2.1.1 Meteorology

Meteorological data were gathered from the online archive of the National Centers for Environmental Prediction, Weather Prediction Center (Kalnay et al. 1996; NOAA 2017). These data include continental United States surface observations and 500 mb height contours for each day of interest. The 500 mb height contours chart (Figure 1A-E) shows height contours (solid lines, measured in dekameters above sea level), temperatures (dashed lines, degrees Celsius), and wind (arrows showing direction and speed) at the 500 mb pressure level at 0700 Eastern Standard Time (EST).

The surface charts (e.g., Figure 12) show weather station observations that include surface wind speed, surface wind direction, temperature, dew point temperature, observed weather, surface pressure, the latest 3-hour pressure tendency, visibility, and cloud cover. In addition, the surface charts contain the surface level isobars, local high and low pressure systems, front locations, and precipitation regions. All observations and frontal analyses are valid for 0700 EST.

2.1.2 Satellite Data and Back Trajectories

Satellite data included in the back trajectory maps are MODIS[4] Fire Detects and HMS[5] Analyzed Smoke Polygons. The fire detects compile Terra and Aqua MODIS fire and thermal anomalies data and are provided as centroids of the 1 kilometer fire detections. Geographic information system (GIS) data were downloaded from *fsapps.nwcg.gov/afm/gisdata.php*. Data presented on the maps are selected by date. The smoke polygons represent visible smoke delineated by National Oceanic and Atmospheric Administration analysts from GOES[6] satellite imagery. GIS data were downloaded from *satepsanone.nesdis.noaa.gov/FIRE/fire.html*. Data plotted on the maps are symbolized by smoke density.

Back trajectories were run in PC HYSPLIT[7], version 4 (Stein et al. 2015). Meteorological data used in the model are from the HRRR[8] 3 kilometer Forecast Data Archive (NOAA 2016).

[4] moderate-resolution imaging spectroradiometer
[5] Hazard Mapping System
[6] Geostationary Operational Environmental Satellite
[7] Hybrid Single-Particle Lagrangian Integrated Trajectory
[8] High-Resolution Rapid Refresh

Planetary boundary layer height (PBLH) was determined by examining the meteorological files at 0Zulu Time(Z), 6Z, 12Z, and 18Z on each day. The approximate lowest and highest boundary layer heights for the 24-hour period ending at midnight local time were observed. Back trajectory starting heights were then chosen to bracket the PBLH at 0.9 * highest PBLH (high), 0.5 * highest PBLH (mid), and at 0.5 * lowest PBLH (low). Back trajectories were run for the 24-hour period ending at midnight. New trajectories started each hour and were run at the three starting heights. Trajectory output files were examined and any parts of trajectories that intersected the surface (or were subsequent to intersection with the surface) were removed (Draxler 2018). HYSPLIT trajectory output was converted to linear features and symbolized in ESRI ArcGIS Pro 2.1.

2.1.3 Time Series

Hourly $PM_{2.5}$ and PM_{10} monitor data were obtained from EPA's Air Quality System (*aqs.epa.gov/aqsweb/airdata/download_files.html*). Meteorological variables from the Pinehurst monitor were obtained from DEQ's Envista Air Resource Manager System. All plots and calculations for time series data were performed in R, version 3.3.2.

2.2 September 4, 2017

2.2.1 Meteorological Evidence: Transport of Emissions to Monitor

Morning 500 mb wind barbs indicated speeds of around 15 knots (kt) at 18,000 feet from the northwest (Figure 1A). Surface readings from the Spokane International Airport indicated calm winds, reduced visibility, a mostly obscured sky, and a cold front located just to the west of Pinehurst (Figure 12). Calm winds extended from southwestern Oregon, north to the Canadian border, and east to central Montana and Utah.

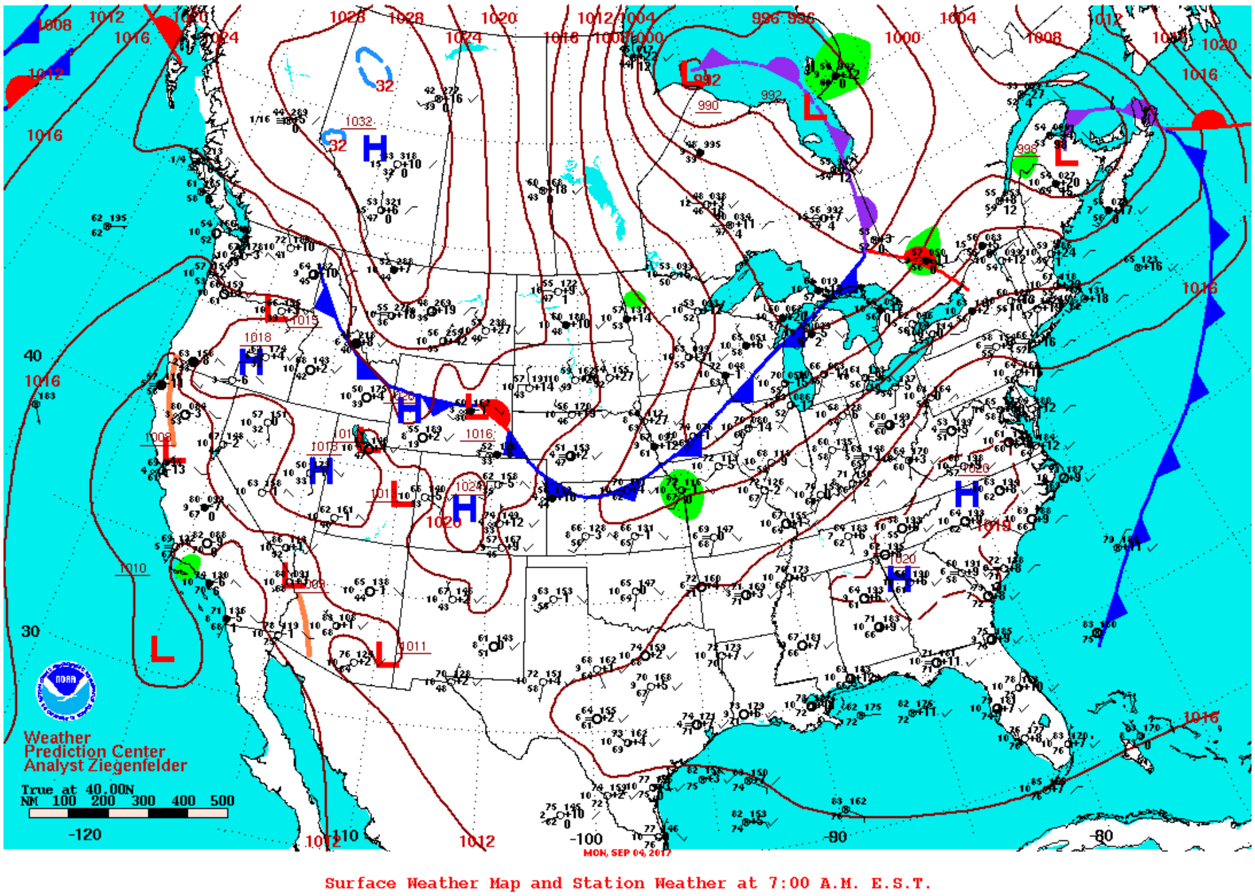


Figure 12. Surface weather map and station weather for September 4, 2017, valid at 0700 EST.

2.2.2 Satellite and Back Trajectory Evidence: Spatial Relationship between Source and Monitor

Figure 13 shows a high density smoke plume covering the northern three-quarters of Idaho, including Pinehurst. Back trajectories reach east into Montana toward wildfires denoted by fire detection data. The back trajectories intersect both the smoke plume and the fire detects, indicating that air parcels arriving at the Pinehurst monitor on September 4 carried smoke from these and other fires.

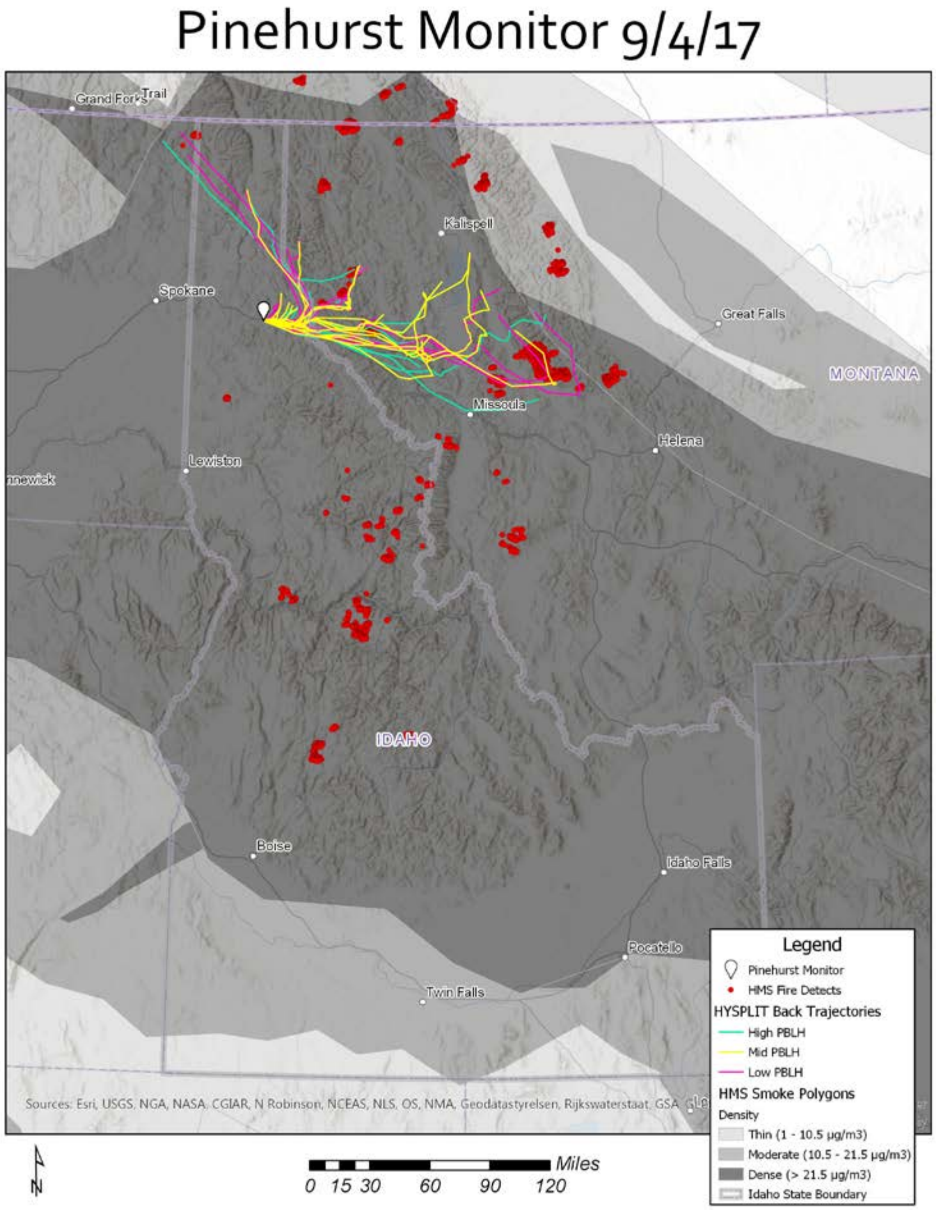


Figure 13. HYSPLIT back trajectories modeling air transport from source area to monitor during 24-hour event period on September 4, 2017.

2.2.3 Time Series Evidence: Temporal Description of Event Day

Hourly $PM_{2.5}$ concentrations at Pinehurst rose quickly from normal levels at 10 a.m. PDT on September 4 and remained above 200 µg/m^3 for the rest of the day after 1 p.m. PDT (Figure 14). All hours on September 4 had values above the 3-year 95th percentile hourly average for September, which indicates the unusual impact of the event on the monitor.

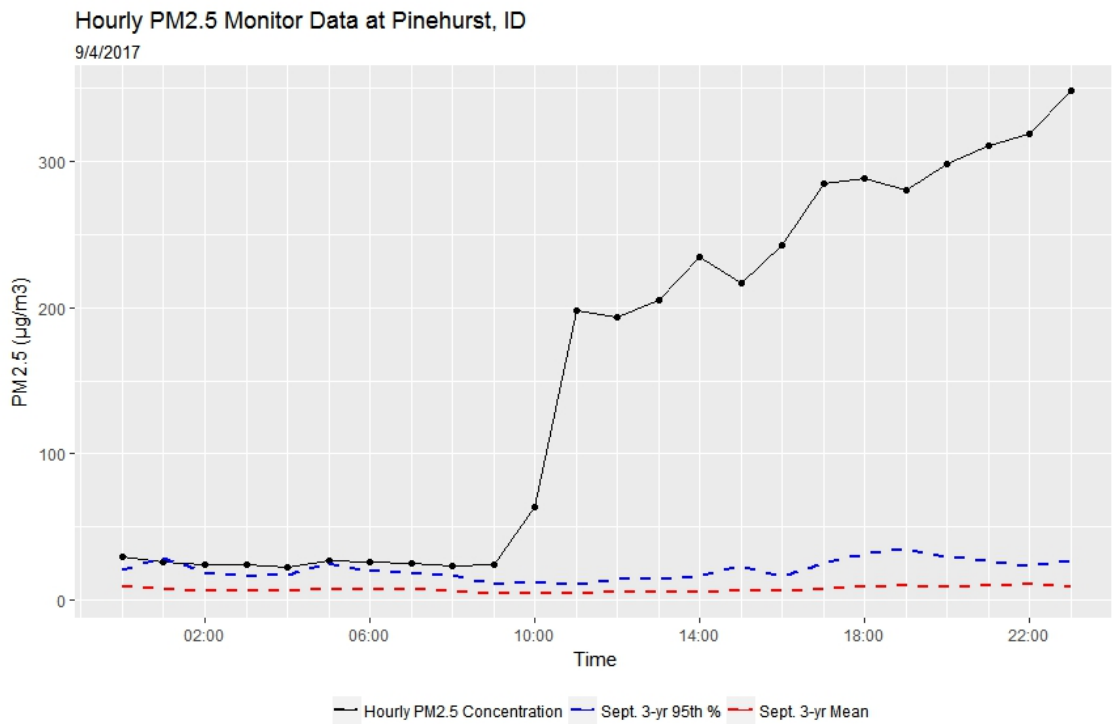


Figure 14. 24-hour time series of $PM_{2.5}$ concentration at Pinehurst monitor on September 4, 2017, compared to average and 95th percentile values at each hour from a 3-year historical mean.

Wind speeds increased at 1 p.m. but were generally low (Figure 15). Wind directions maintained a northerly aspect throughout the day. Solar radiation was somewhat suppressed by the heavy smoke between 1 and 2 p.m. as evidenced by the quick drop in solar radiation at that time. The typical diurnal shape of a sunny day solar radiation time series is more rounded at the apex (Stine and Harrigan 2018). Temperature data reveal September 4 to be a typical hot day in late summer.

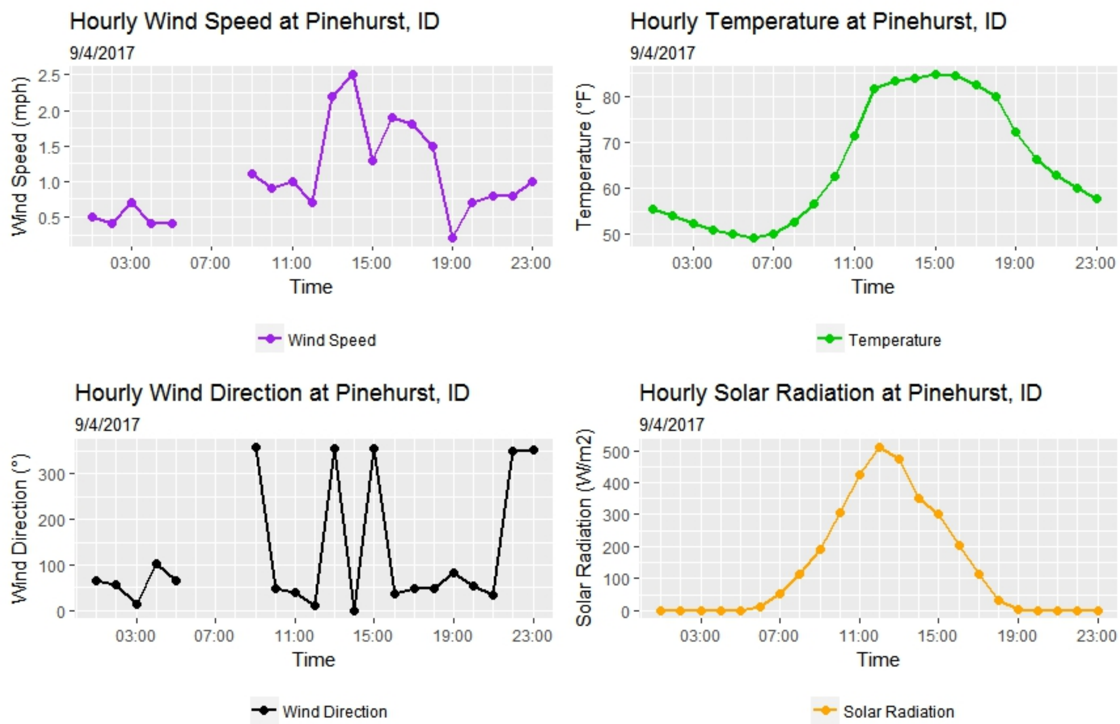
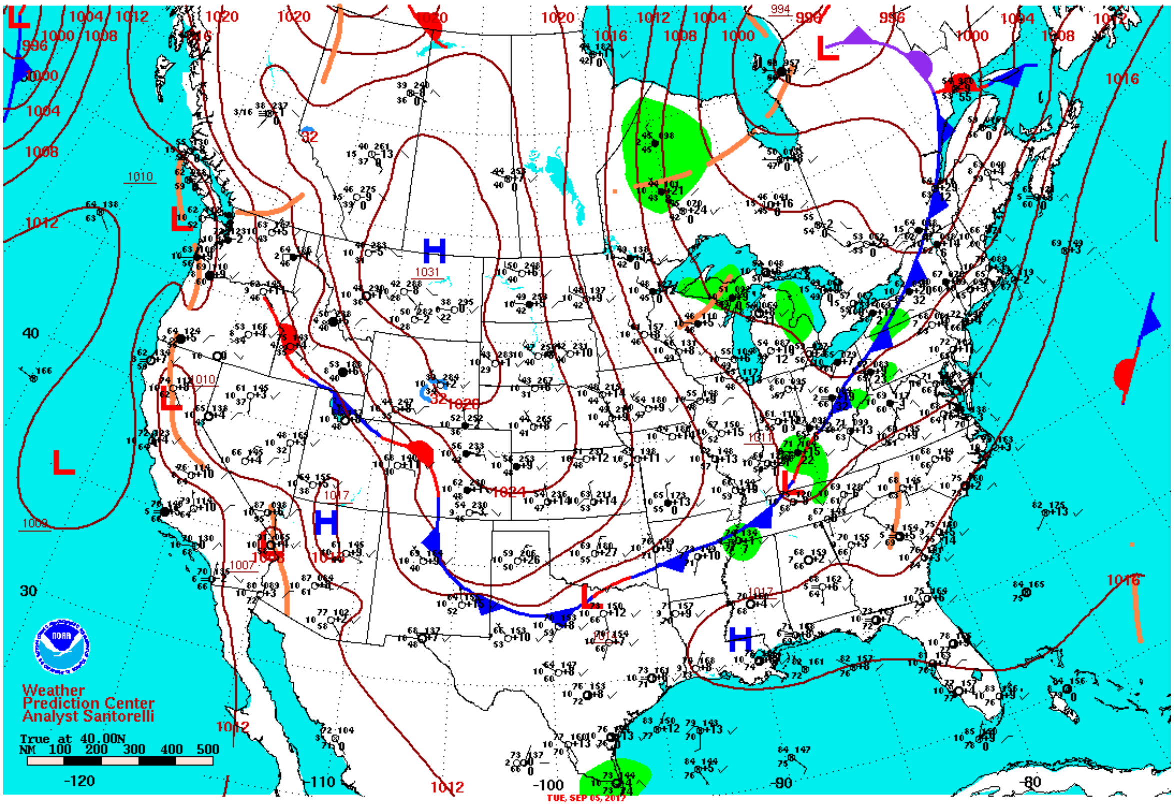


Figure 15. 24-hour time series of meteorological variables at Pinehurst, Idaho, on September 4, 2017.

2.3 September 5, 2017

2.3.1 Meteorological Evidence: Transport of Emissions to Monitor

Morning 500 mb wind barbs indicated speeds of 10 kt at around 18,000 feet from the west-northwest (Figure 1B). Surface readings from the Spokane International Airport indicated calm winds, reduced visibility to 2 statute miles, a completely overcast sky, and a rising station pressure. A stationary front sat to the southwest (Figure 16). Calm winds extended from southwestern Oregon, north to the Canadian border, and east to central Montana and Utah.



Surface Weather Map and Station Weather at 7:00 A.M. E.S.T.

Figure 16. Surface weather map and station weather for September 5, 2017, valid at 0700 EST.

2.3.2 Satellite and Back Trajectory Evidence: Spatial Relationship between Source and Monitor

Figure 17 shows a high density smoke plume covering the entirety of Idaho, including Pinehurst. Back trajectories reach north and east toward wildfires denoted by fire detection data. The back trajectories intersect both the smoke plume and the fire detects, indicating that air parcels arriving at the Pinehurst monitor on September 5 carried smoke from these and other fires.

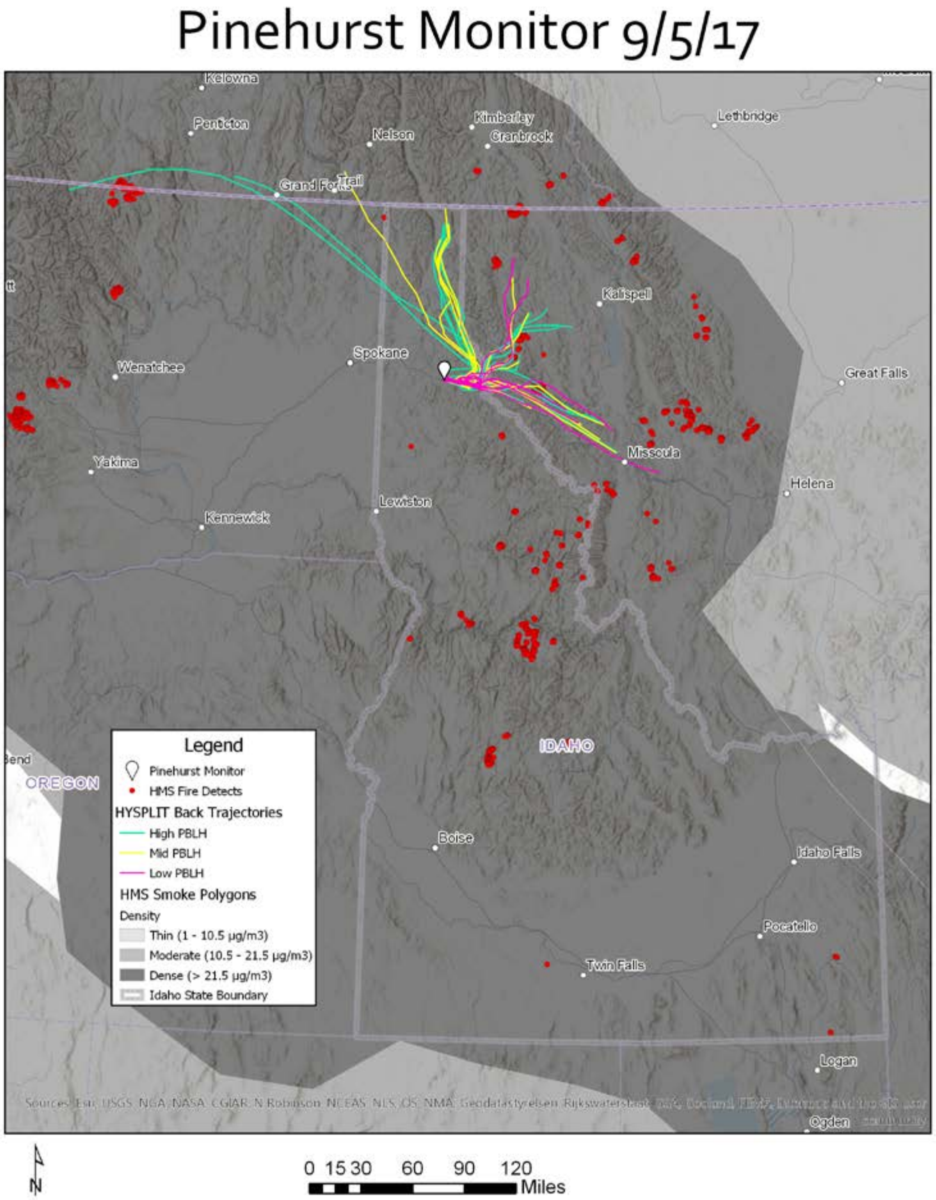


Figure 17. HYSPLIT back trajectories modeling air transport from source area to monitor during 24-hour event period on September 5, 2017.

2.3.3 Time Series Evidence: Temporal Description of Event Day

Hourly $PM_{2.5}$ concentrations at Pinehurst began the day above 350 µg/m^3, dropped steadily to a low just above 100 µg/m^3 at 11 a.m. PDT, rose again to 250 µg/m^3 in the afternoon, and ended the day at about 175 µg/m^3 (Figure 18). The diurnal pattern suggests that smoke concentrations were falling and rising with the raising and lowering of the boundary layer, with calm winds providing no displacement of the smoke. Wind speeds were below 2 miles per hour (mph, or 1.74 kt) (Figure 19). Solar radiation dropped rapidly at 1 and 2 p.m. PDT, corresponding to increased concentrations at the monitor. All hours on September 5 had values above the 3-year

95th percentile hourly average for September (Figure 18), which indicates the unusual impact of the event on the monitor.

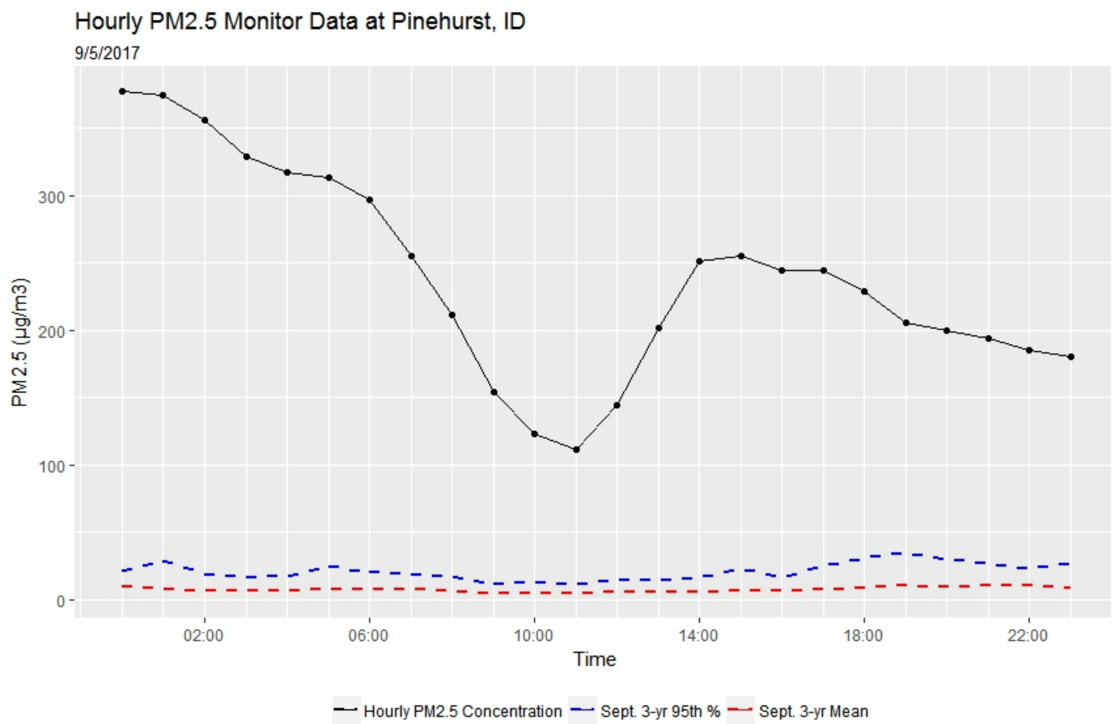


Figure 18. 24-hour time series of $PM_{2.5}$ concentration at Pinehurst monitor on September 5, 2017, compared to average and 95th percentile values at each hour from a 3-year historical mean.

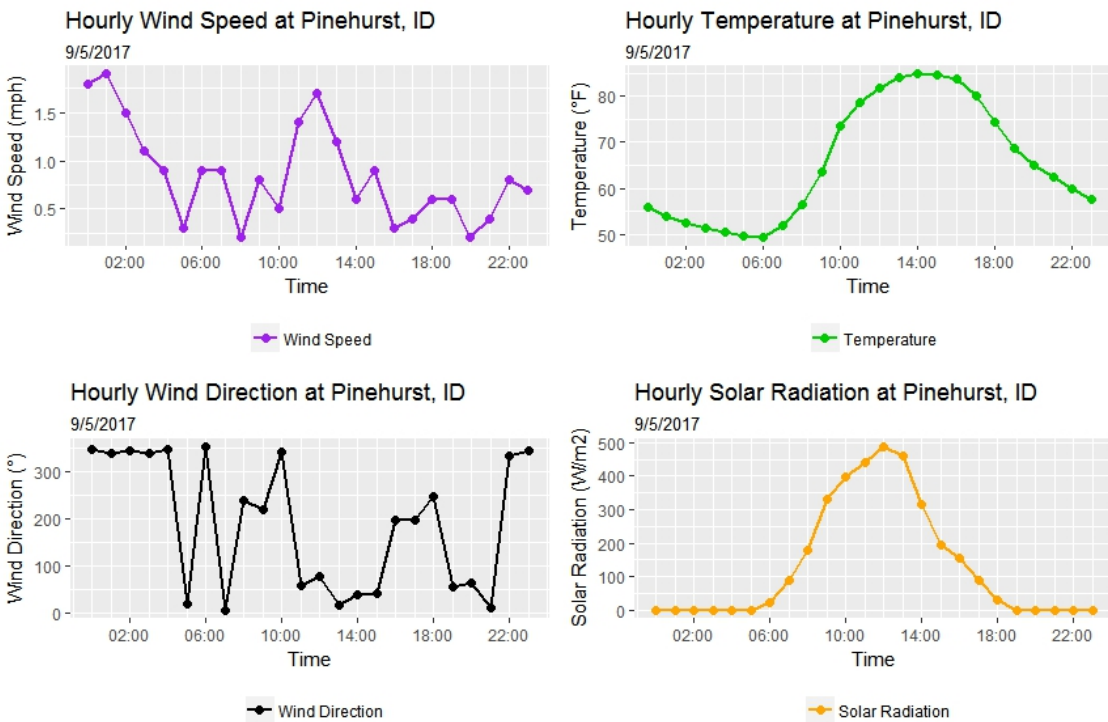
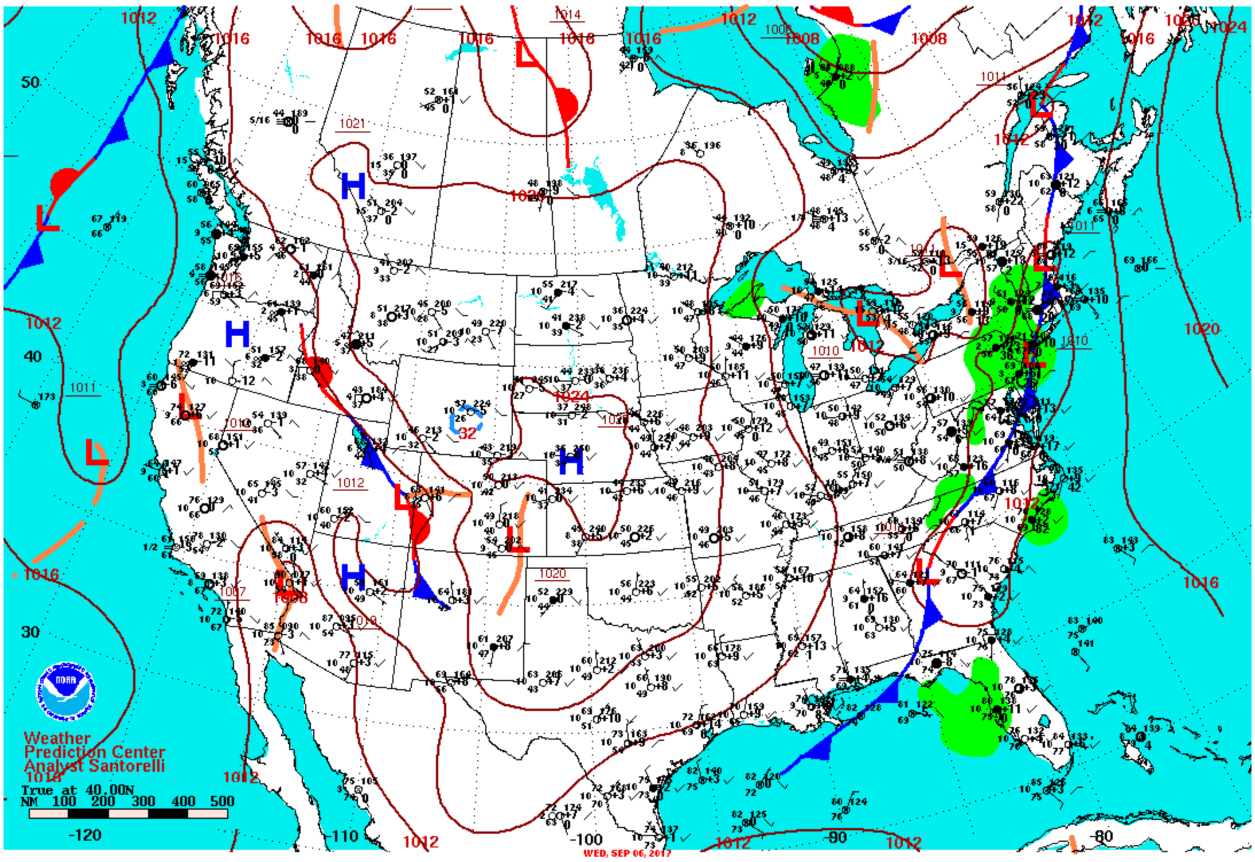


Figure 19. 24-hour time series of meteorological variables at Pinehurst, Idaho, on September 5, 2017.

2.4 September 6, 2017

2.4.1 Meteorological Evidence: Transport of Emissions to Monitor

By September 6, the ridge axis ran through southwestern Idaho into eastern Washington. Figure 1C indicates upper-level winds at around 20 kt at 18,000 feet over eastern Washington and lighter wind speeds to the south over central Idaho. Visibility had fallen to 2 statute miles, with calm winds at the surface, complete obscuration, and increasing pressure over the 3 hours prior to 0700 EST before leveling off (Figure 20).



Surface Weather Map and Station Weather at 7:00 A.M. E.S.T.

Figure 20. Surface weather map and station weather for September 6, 2017, valid at 0700 EST.

2.4.2 Satellite and Back Trajectory Evidence: Spatial Relationship between Source and Monitor

Figure 21 displays a similar day to September 5. Dense smoke covered Idaho, including Pinehurst, and many wildfires burned in central Idaho and northwestern Montana. Back trajectories traveled mainly south and east from the fire sources, through the dense smoke, to the monitor in Pinehurst. Air parcels arriving at Pinehurst during the 24-hour period of September 6 clearly intersected smoke polygons and fire detects (Figure 21).

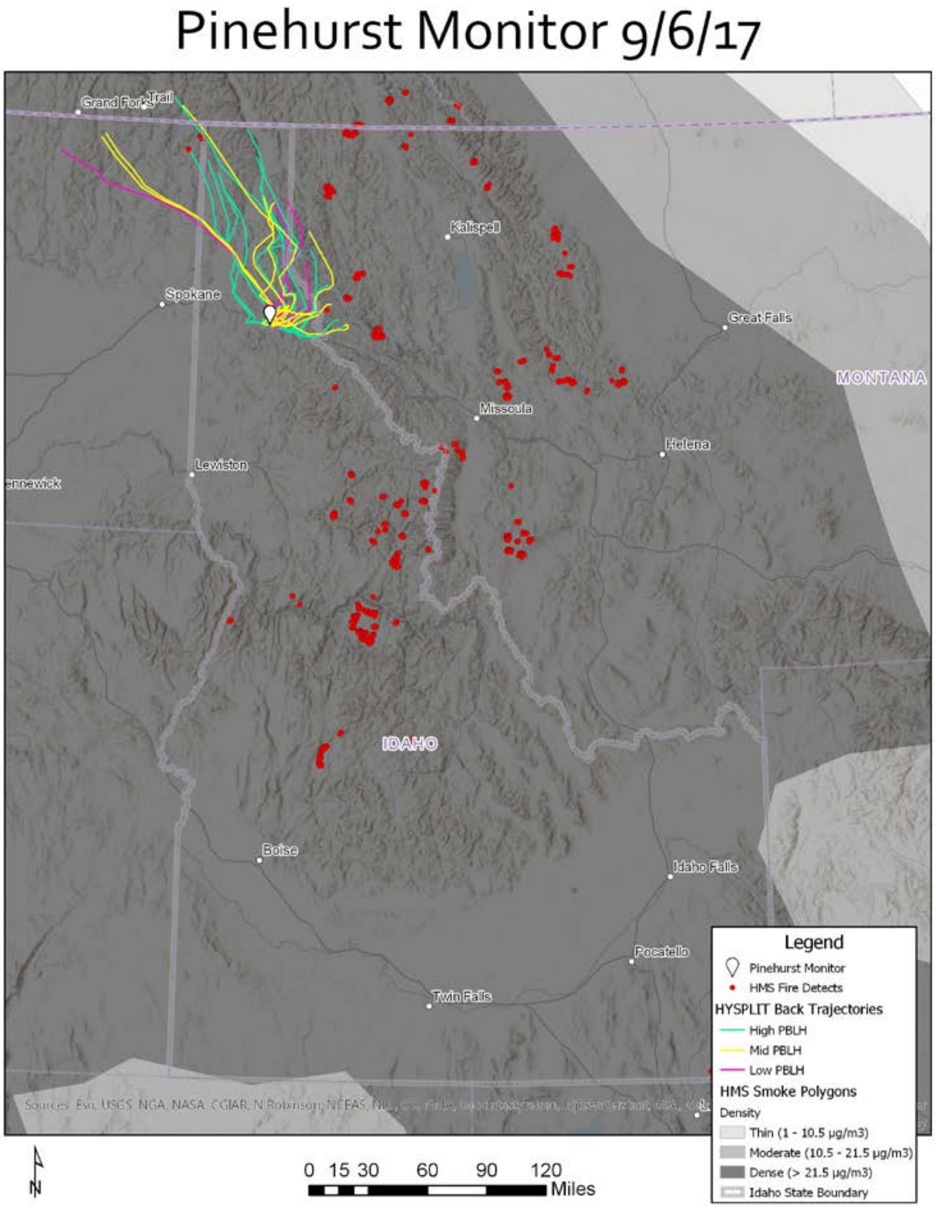


Figure 21. HYSPLIT back trajectories modeling air transport from source area to monitor during 24-hour event period on September 6, 2017.

2.4.3 Time Series Evidence: Temporal Description of Event Day

$PM_{2.5}$ concentrations on September 6 remained above 125 µg/m^3 for the day (Figure 22). Concentrations peaked above 200 µg/m^3 at midday. All hours were elevated above the 3-year average 95th percentile.

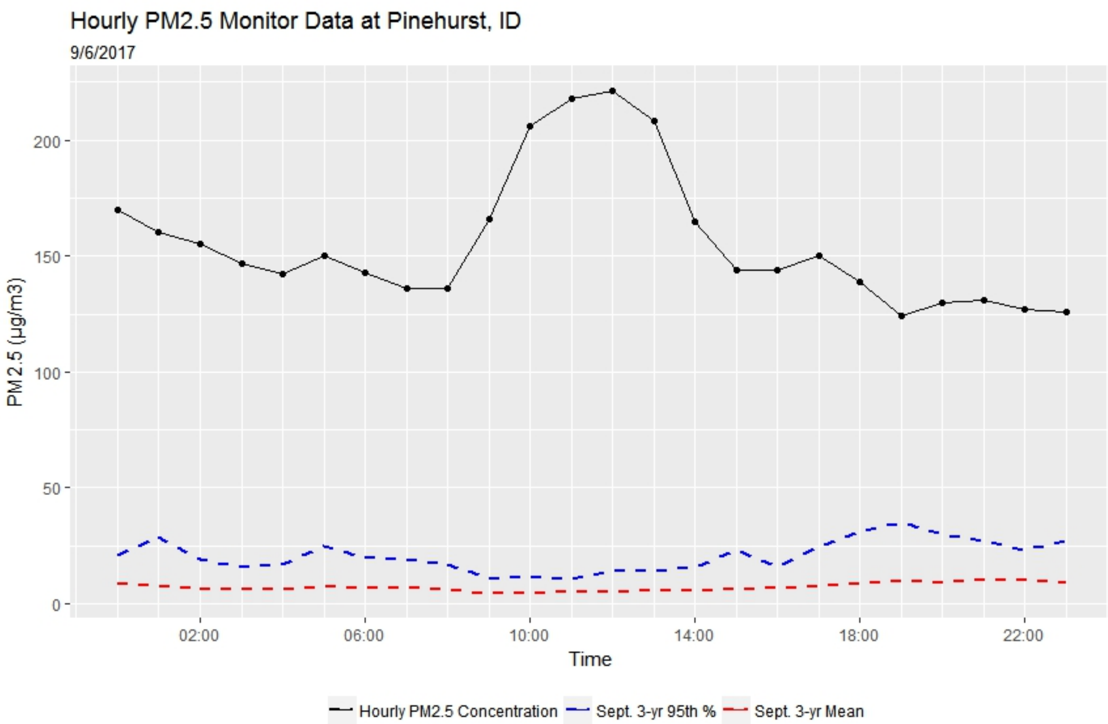


Figure 22. 24-hour time series of $PM_{2.5}$ concentration at Pinehurst monitor on September 6, 2017, compared to average and 95th percentile values at each hour from a 3-year historical mean.

PM_{10} concentrations followed a similar diurnal pattern to $PM_{2.5}$, staying high in the morning and evening while rising during midday (Figure 23). All hours were elevated above the 3-year average 95th percentile.

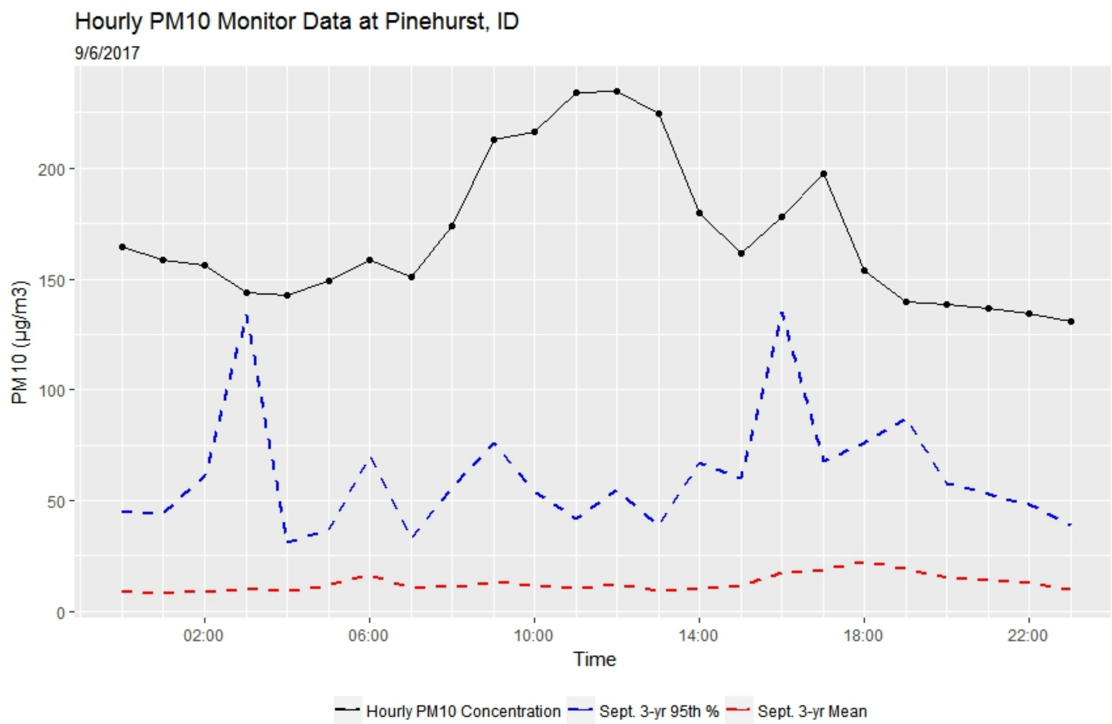


Figure 23. 24-hour time series of PM_{10} concentration at Pinehurst monitor on September 6, 2017, compared to average and 95th percentile values at each hour from a 3-year historical mean. Wildfire (IT) and high winds (IJ) flagged data were removed from the 95th percentile values.

Wind speeds were very low on September 6, remaining below 1.4 mph (1.22 kt) (Figure 24). The hours before the midday increases show the winds coming from the north, bringing smoke through the one topographical opening into the Pinehurst Valley. Temperature and solar radiation data indicate another hot and sunny day in Pinehurst.

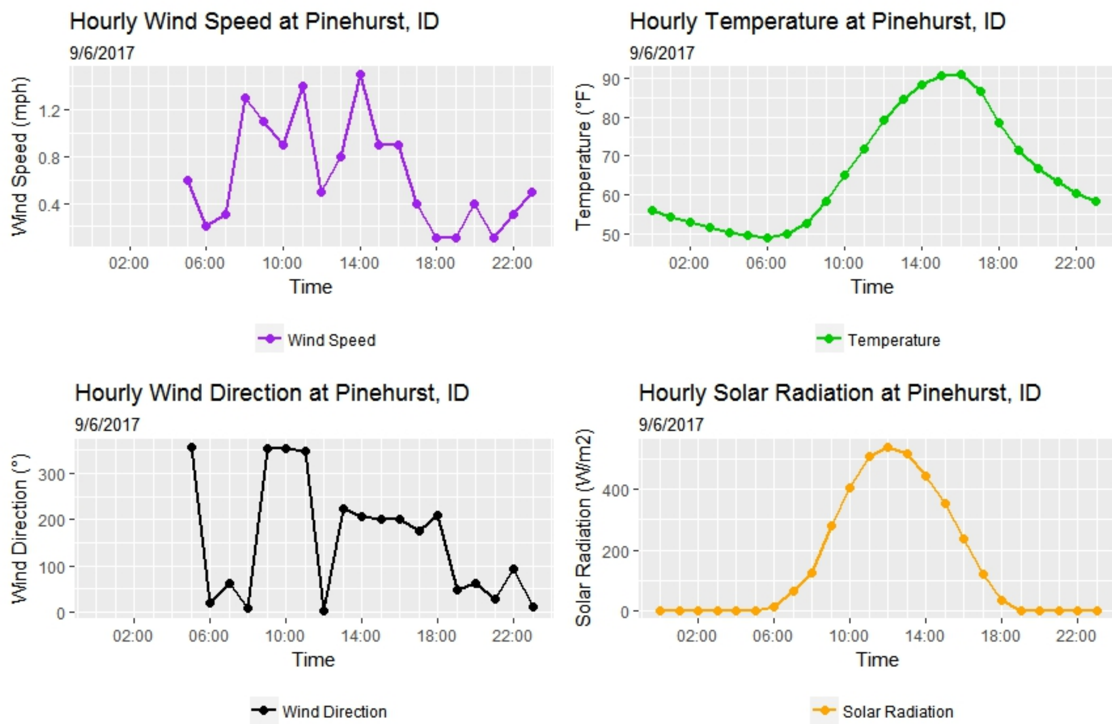
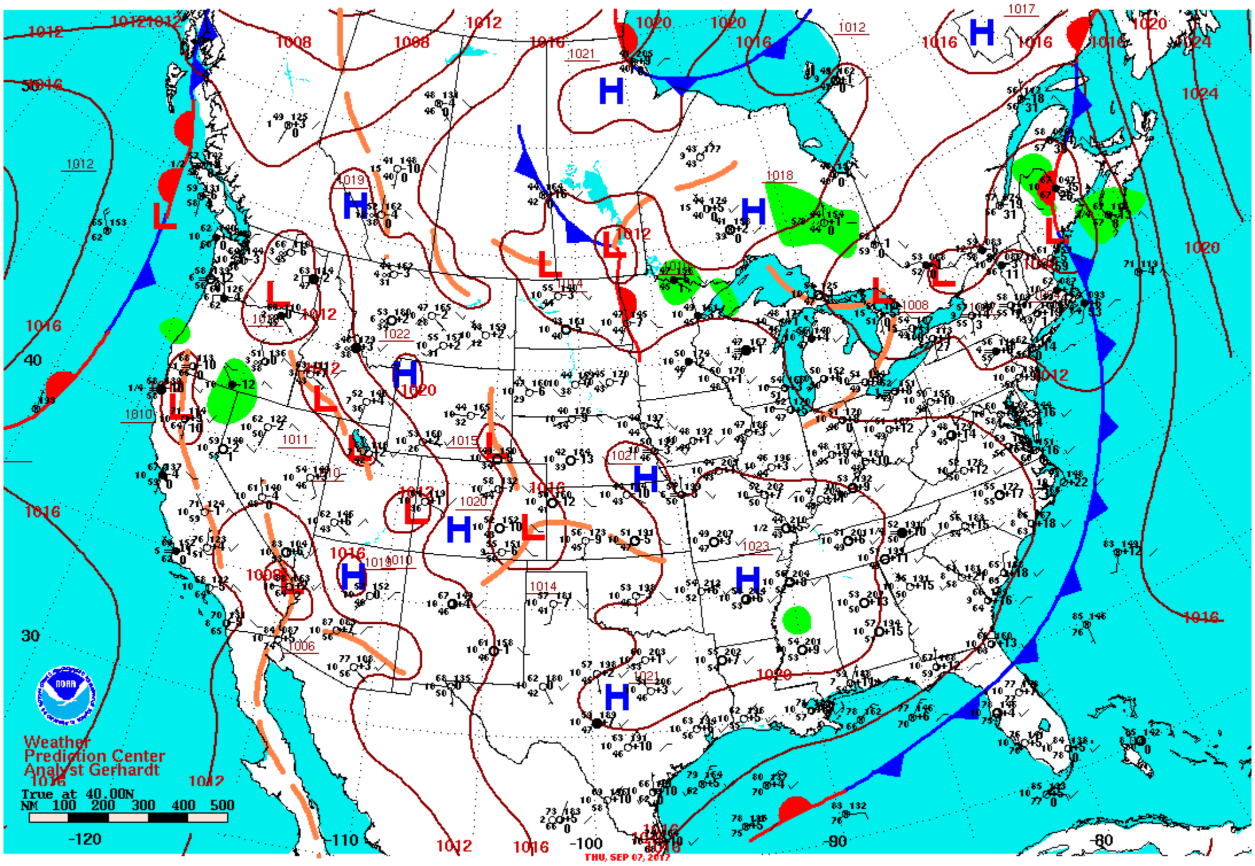


Figure 24. 24-hour time series of meteorological variables at Pinehurst, Idaho, on September 6, 2017.

2.5 September 7, 2017

2.5.1 Meteorological Evidence: Transport of Emissions to Monitor

On September 7, the mid-level ridge axis shifted east, moving directly over the area of interest (Figure 1D). The 18,000-foot winds were less than 10 kt over the entire region. Calm surface winds were observed (5 kt or less) at the Spokane International Airport. Skies were completely obscured and visibility was limited to 2 statute miles. As with September 6, this visibility decrease was due to surface smoke (Figure 25).



Surface Weather Map and Station Weather at 7:00 A.M. E.S.T.

Figure 25. Surface weather map and station weather for September 7, 2017, valid at 0700 EST.

2.5.2 Satellite and Back Trajectory Evidence: Spatial Relationship between Source and Monitor

On September 7, the large, dense smoke plume was still in place over most of Idaho (Figure 26). Southwesterly winds had pushed smoke out of the southwest corner of the state. Some of the back trajectories reflect the regional wind shift, bringing parts of the leftover smoke plume northeasterly into Pinehurst. Other trajectories transported smoky air from Montana fires into Pinehurst.

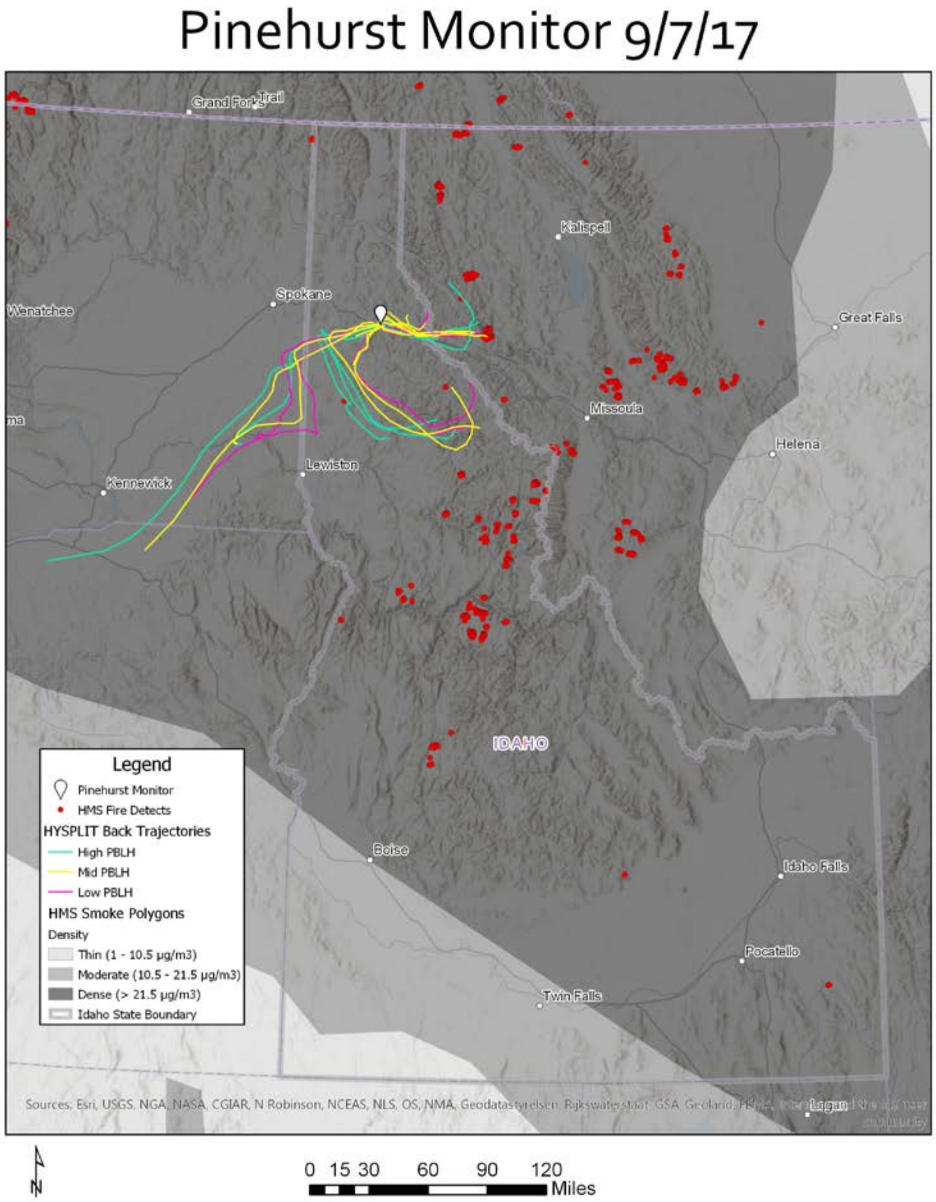


Figure 26. HYSPLIT back trajectories modeling air transport from source area to monitor during 24-hour event period on September 7, 2017.

2.5.3 Time Series Evidence: Temporal Description of Event Day

On September 7, the $PM_{2.5}$ concentration time series was similar in shape to the previous day—high and steady in the morning and evening with a maximum at midday (Figure 27). Overall, the concentrations were lower than on September 6, reflecting the weakening ridge and subsequent rising mixing heights. Concentrations for the day were significantly greater than the 3-year average 95th percentile.

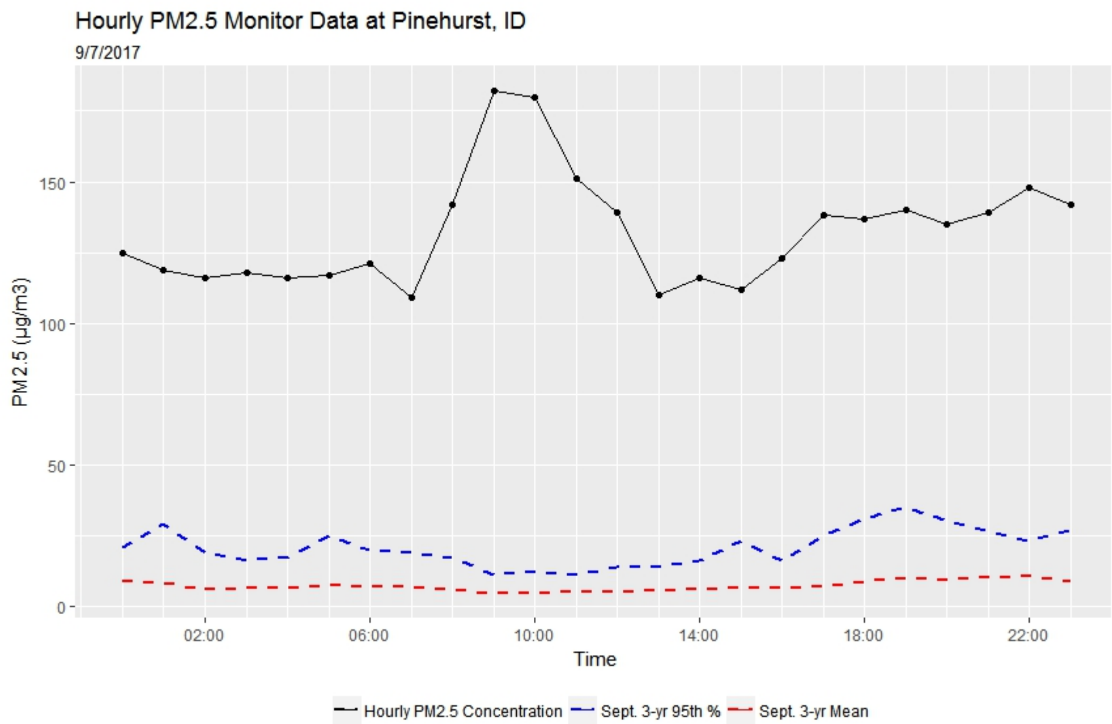


Figure 27. 24-hour time series of $PM_{2.5}$ concentration at Pinehurst monitor on September 7, 2017, compared to average and 95th percentile values at each hour from a 3-year historical mean.

PM_{10} concentrations were high and level in the morning, rose to a maximum at midday, and peaked again at 6 p.m. PDT (Figure 28). Final concentrations ended the day higher than at the start. Most hours recorded concentrations well above the 3-year 95th percentile for PM_{10}.

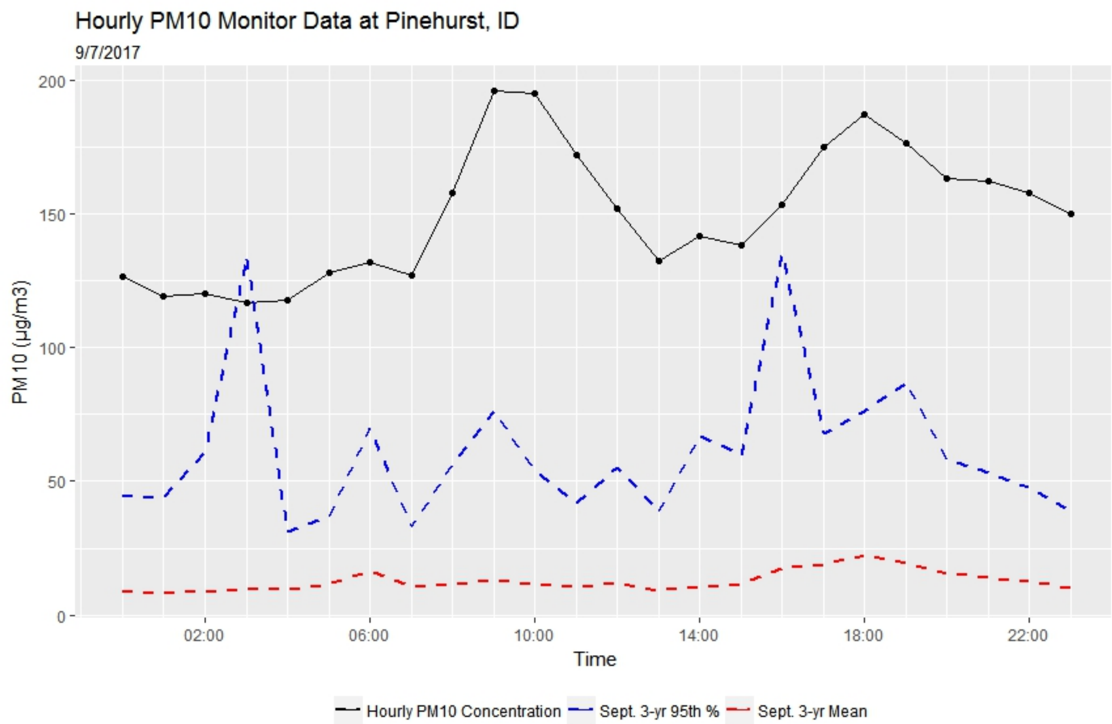


Figure 28. 24-hour time series of PM_{10} concentration at Pinehurst monitor on September 7, 2017, compared to average and 95th percentile values at each hour from a 3-year historical mean. Wildfire (IT) and high winds (IJ) flagged data were removed from the 95th percentile values.

Wind speeds rose above 2 mph (1.74 kt) after 2 p.m. PDT accompanied by a rise in concentrations (Figure 29). Winds were southwesterly then, matching the trajectory directions. Temperatures in Pinehurst were the highest since the episode began. The only solar radiation suppression was detectable at 11 a.m. PDT when concentrations reached a maximum for the day.

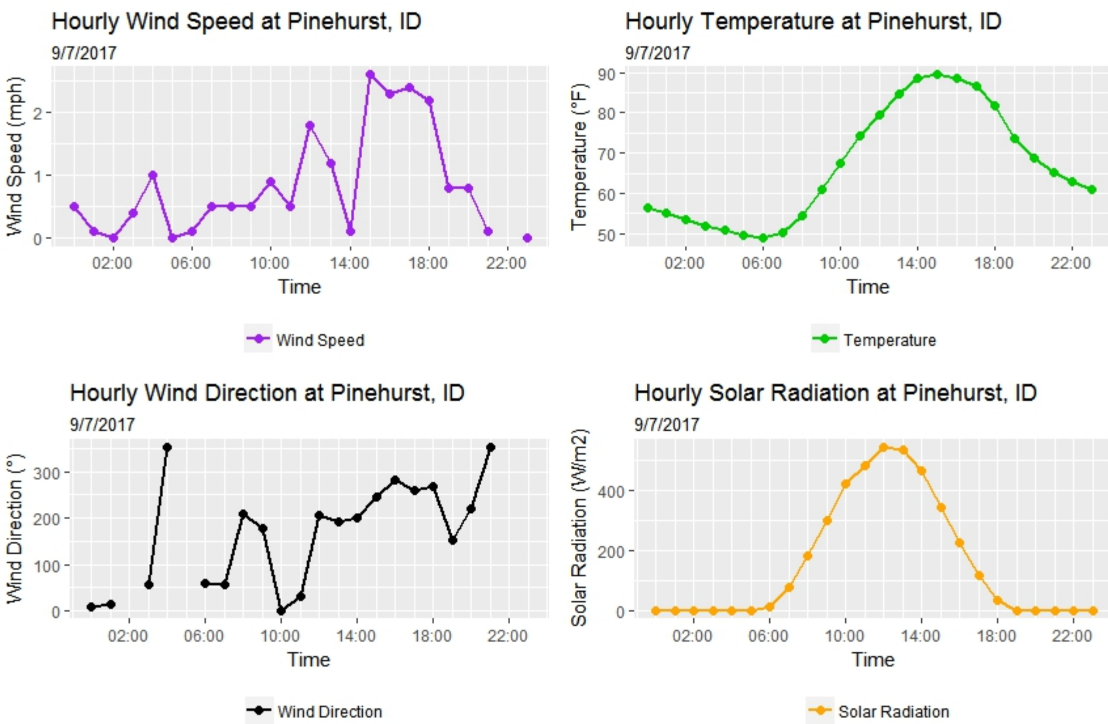


Figure 29. 24-hour time series of meteorological variables at Pinehurst, Idaho, on September 7, 2017.

2.6 September 8, 2017

2.6.1 Meteorological Evidence: Transport of Emissions to Monitor

On September 8, the mid-level ridge axis shifted east in response to an approaching upper-level low pressure system over central California (Figure 1E). The 18,000-foot winds were around 35 kt with 20 kt winds over southwestern Idaho. Light surface winds came (5 kt or less) from the southwest. There was complete surface obscuration and limited visibility (3 statute miles). Surface pressure decreased quickly before rising as is typical ahead of a cold front passage (Figure 30).

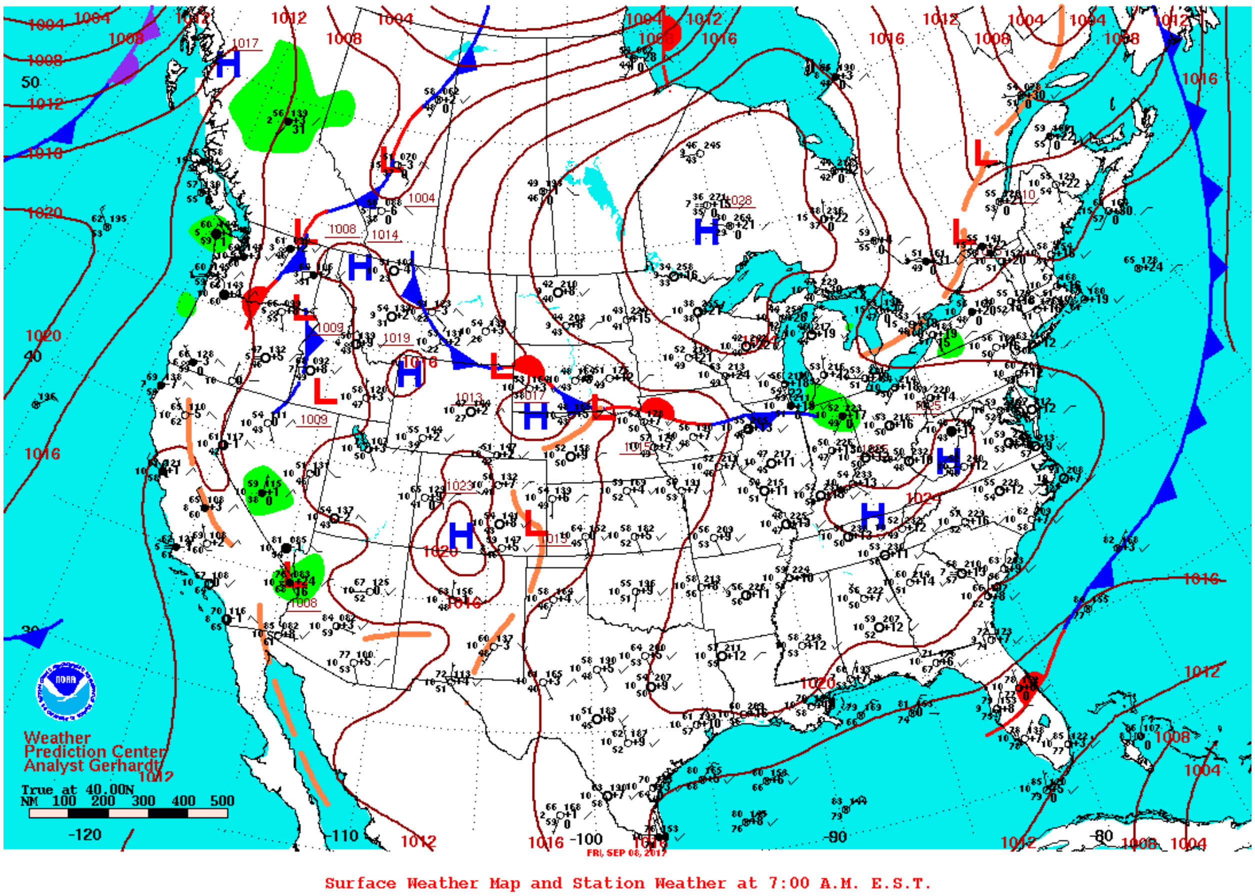


Figure 30. Surface weather map and station weather for September 8, 2017, valid at 0700 EST.

2.6.2 Satellite and Back Trajectory Evidence: Spatial Relationship between Source and Monitor

On the last day of the event, change was evident (Figure 31). The dense plume of smoke still occupied the northern half of Idaho, including Pinehurst, but it had dissipated in southern Idaho. Back trajectories were strongly southwesterly, following the transport winds bringing a cold front to the area. Plenty of smoke remained in southeastern Washington and northern Idaho to be transported to the Pinehurst monitor.

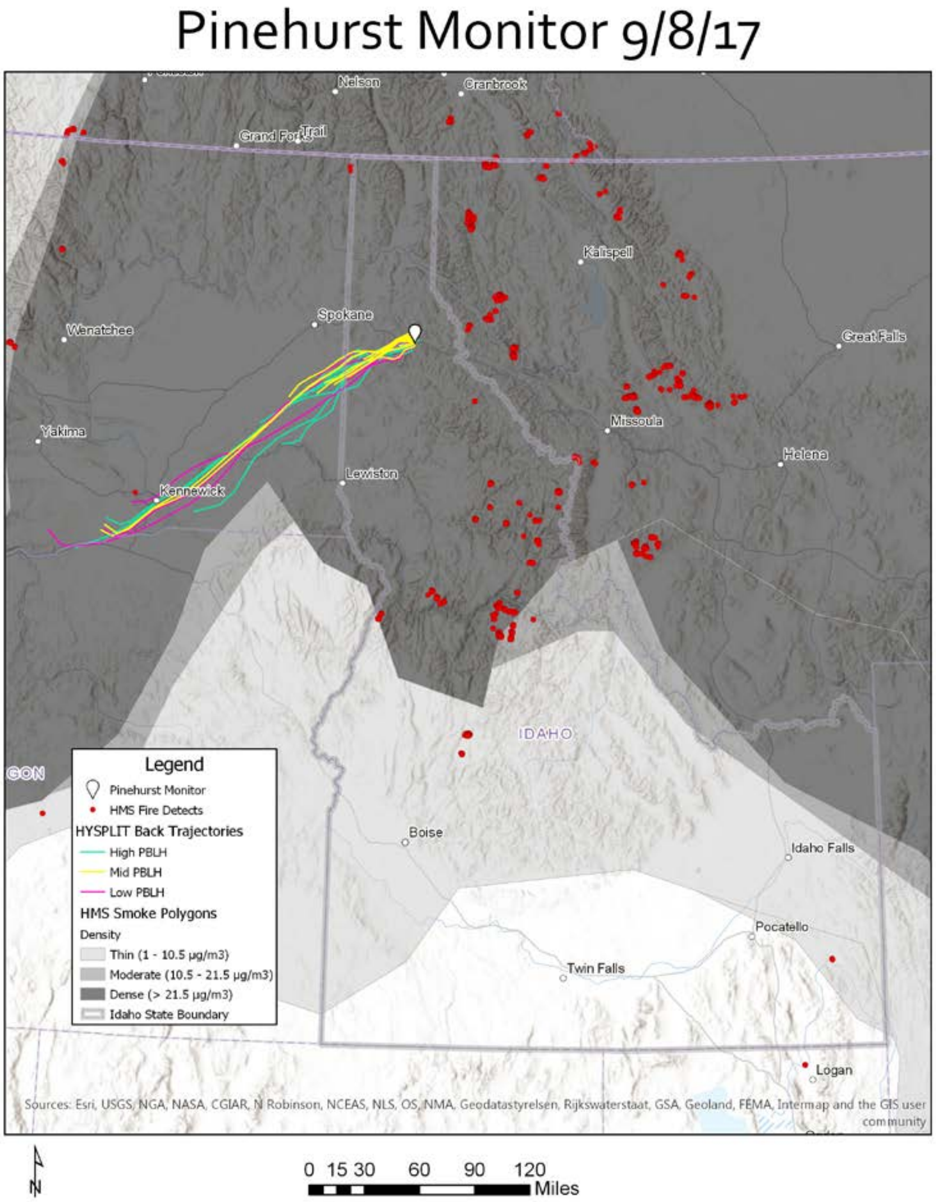


Figure 31. HYSPLIT back trajectories modeling air transport from source area to monitor during 24-hour event period on September 8, 2017.

2.6.3 Time Series Evidence: Temporal Description of Event Day

Concentrations remained high and steady at Pinehurst, hovering around 150 µg/m^3 (Figure 32). Values were again high above the historical mean and 95th percentile concentrations.

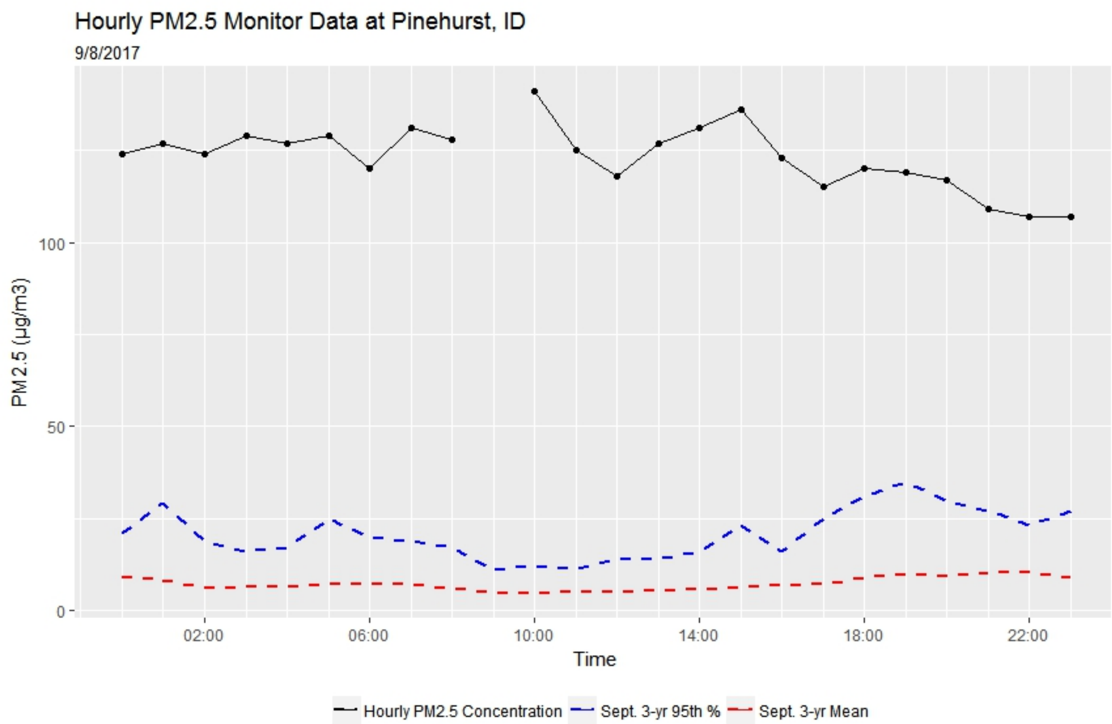


Figure 32. 24-hour time series of $PM_{2.5}$ concentration at Pinehurst monitor on September 8, 2017, compared to average and 95th percentile values at each hour from a 3-year historical mean.

PM_{10} concentrations stayed firmly above 130 µg/m^3 for most of the day with a slight drop toward 120 µg/m^3 in the late evening (Figure 33). All hours recorded concentrations above the 3-year 95th percentile for PM_{10}.

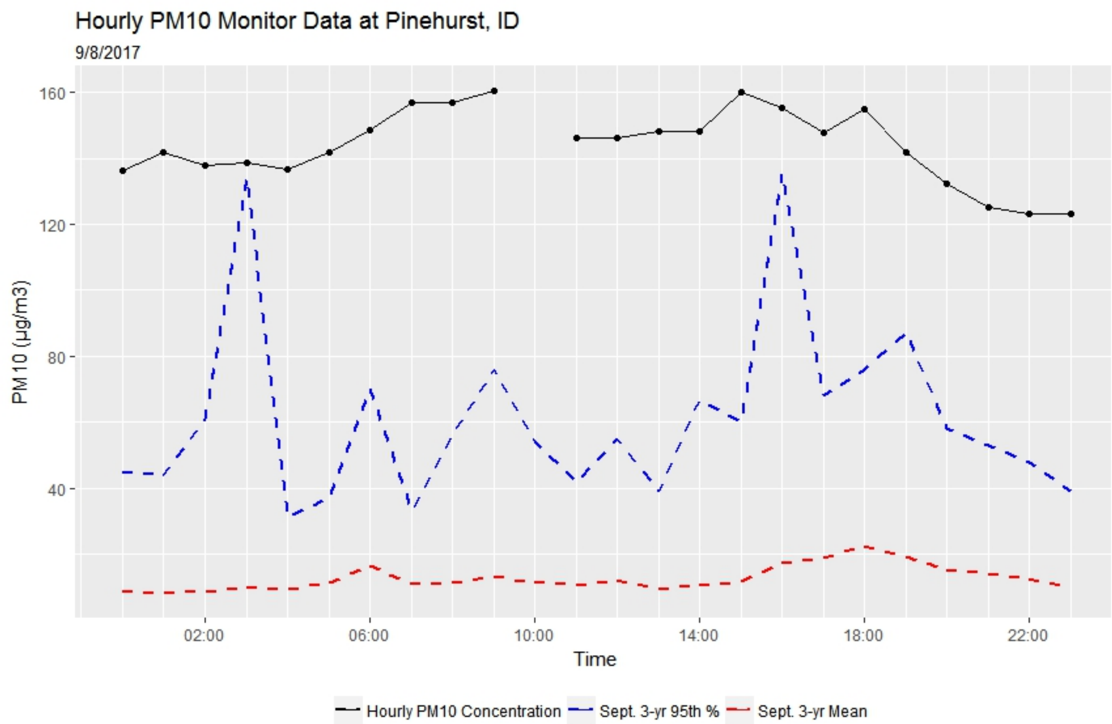


Figure 33. 24-hour time series of PM_{10} concentration at Pinehurst monitor on September 8, 2017, compared to average and 95th percentile values at each hour from a 3-year historical mean. Wildfire (IT) and high winds (IJ) flagged data were removed from the 95th percentile values.

Wind speeds were low on September 8 and then rose to 3 mph (2.61 kt) at midnight PDT (Figure 34). Wind direction was variable in the morning and then southwesterly in the afternoon. It was hot and sunny in Pinehurst.

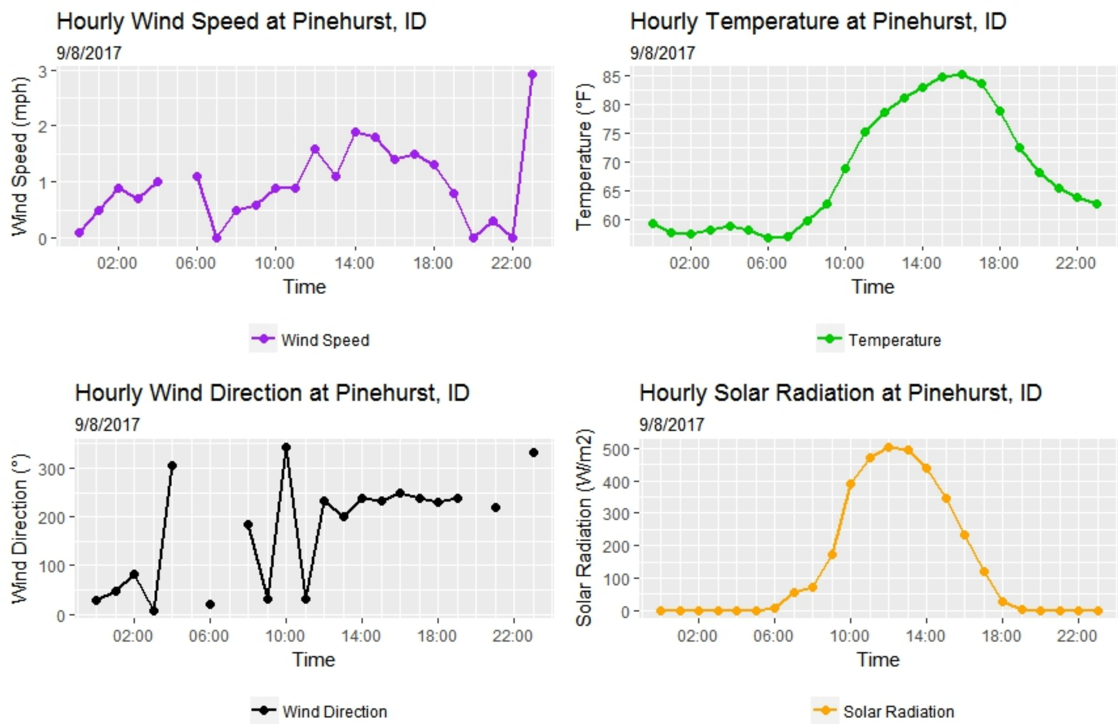


Figure 34. 24-hour time series of meteorological variables at Pinehurst, Idaho, on September 8, 2017.

2.7 Alternative Source Hypotheses

An important element of the clear causal relationship demonstration is to explore alternative hypotheses for sources of $PM_{2.5}$ and PM_{10}. Anthropogenic sources include prescribed fires, crop residue burning (CRB), residential wood combustion (RWC), open burning, and vehicle emissions. Statewide, the magnitude of these $PM_{2.5}$ emissions is small compared to wildfire emissions (Figure 5). These anthropogenic sources maintain relatively steady emissions from year to year and are included in the historical monitor values.

2.7.1 Prescribed Burning

Prescribed burning in Idaho is regulated under IDAPA 58.01.01.614. All federal and state prescribed burners, as well as most large private prescribed burners, are members of the Montana/Idaho Airshed Group (*www.smokemu.org*). Members follow an operating guide based on Basic Smoke Management Practices (BSMP). The group also logs prescribed burns in a database, which shows no prescribed burns occurred on September 4, 5, 6, 7, or 8, 2017 (Figure 35).

CompDate	Member	Unit Name	Comment/Location	Type	T/ac	Acres	CompAcres	Tons Burned	NoBurnReason
06/29/2017	US Forest Service	AIPD 2017 Spring Pile Burns	East side of the District: Bighorn Estates and Meadow Creek areas.	Hand Piles	5	324	0	0	Not in prescription
08/26/2017	Idaho Dept of Lands	Goosey Bear	14 miles Northeast of Coolin, Idaho.	Rights of Way	15	15	0	0	Self-limited (e.g. following test fire)
09/20/2017	Idaho Dept of Lands	Lookout Below Fire HM Excavator Piles	Excavator Piles from the sale and salvage of burned timber.	Other Mechanical	9	149	5	45	

Figure 35. Extract from Montana/Idaho Airshed Group prescribed burning database with dates bracketing exceptional event days.

2.7.2 Crop Residue Burning

CRB in Idaho is regulated under IDAPA 58.01.01.617. DEQ administers a CRB program that requires growers to register for a permit and obtain approval before burning (*www.deq.idaho.gov/media/1117949/crb-operating-guide.pdf*). DEQ maintains a database of approved and accomplished burns as part of the CRB program, and the records can be accessed online (*www.deq.idaho.gov/air-quality/burning/daily-crop-burn-decision/burn-requests-and-approvals/*). No CRB burns occurred in Idaho on September 2, 3, 4, 5, 6, 7, or 8, 2017. The statewide burn decision was *No Burn Due to Air Quality*. No requests were received for CRB burning on September 2, 3, 4, 5, 6, 7, or 8, 2017, in Shoshone County.

2.7.3 Residential Wood Combustion

RWC can be a significant source of $PM_{2.5}$ and PM_{10} emissions in Idaho communities during the winter. The temperature in Pinehurst on September 4–8 ranged from 50 to 90 degrees Fahrenheit (°F) (Figure 15, Figure 19, Figure 24, Figure 29, and Figure 34). RWC was not a likely source of $PM_{2.5}$ or PM_{10} emissions on September 4, 5, 6, 7, or 8, 2017, considering the warmth of the day and night.

2.7.4 Open Burning

All open burning in Idaho is regulated by DEQ under the "Rules for Control of Open Burning" (IDAPA 58.01.01.600). Open burning is included in the nonpoint source category of the 2014 NEI emissions for Idaho (Figure 5). Open burning is one of many sources incorporated in that category, and all of the nonpoint source emissions are half the emissions produced by wildfires during 2017 (40 CFR 50.14(b)(8)(viii)(A)). It is unlikely that the magnitude of annual emissions from open burning could cause the monitor impacts sustained at Pinehurst on September 4, 5, 6, 7, and 8, 2017. An Air Quality Forecast and Caution (*http://www.deq.idaho.gov/media/60180628/stage-1-forecast-and-caution-09052017.pdf*) was issued on 9/4/17 for Benewah, Bonner, Boundary, Kootenai, Shoshone, Latah, Nez Perce, Lewis, Clearwater, and Idaho Counties. The caution was extended statewide on 9/5/17 and was rescinded on 9/9/17. All open burning is banned when an Air Quality Forecast and Caution is in effect (*http://www.deq.idaho.gov/news-archives/2017/september/air-statewide-air-quality-advisory-090517/*).

2.7.5 Vehicle Emissions

Vehicle emissions and road dust produce $PM_{2.5}$ and PM_{10} emissions and are included in the onroad mobile source category in the 2014 NEI (Figure 5). The annual $PM_{2.5}$ emissions in this category are a small fraction of the emissions produced by wildfires, especially in rural areas like

Shoshone County with few vehicles. Onroad mobile emissions did not likely contribute any significant $PM_{2.5}$ or PM_{10} to the elevated concentrations at the Pinehurst monitor on September 4, 5, 6, 7, or 8, 2017.

3 Historical Concentrations

To support the clear causal relationship requirement of the EER, analyses are presented here comparing the event-influenced concentrations at Pinehurst to historical concentrations. Evidence supports the conclusion that $PM_{2.5}$ and PM_{10} concentrations at the Pinehurst monitor on September 4, 5, 6, 7, and 8, 2017, were elevated due to wildfire smoke.

Figure 36 shows the $PM_{2.5}$ concentrations measured at Pinehurst during July through September for 2007 through 2016. Data are shown only for the period spanning a typical fire season because other seasons may see elevated concentrations due to other factors like woodstove emissions or wintertime inversions. The 10-year data set shows that most values remain below 30 µg/m^3 during the fire season, with periodic excursions up to 50 µg/m^3. Three outliers from 2007, an unusually bad fire season, ranged from 90 to 108 µg/m^3.

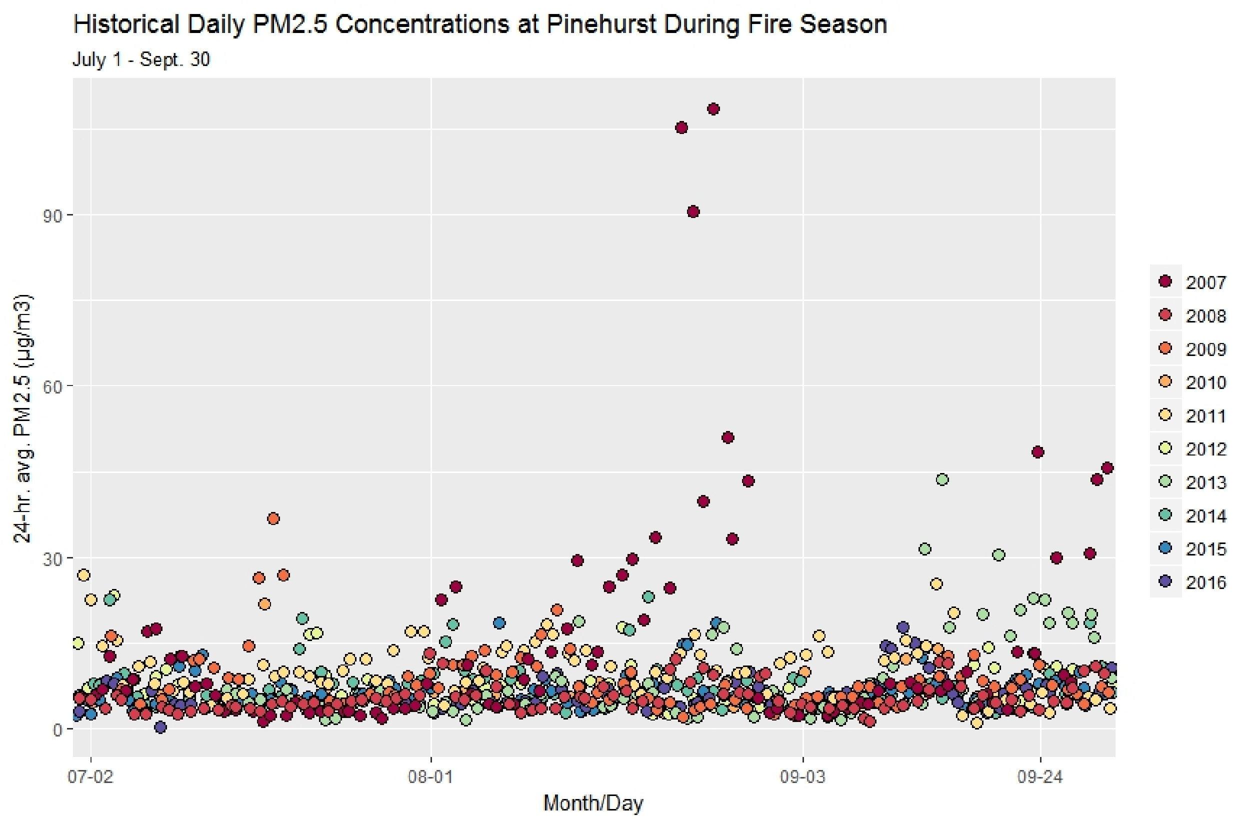


Figure 36. $PM_{2.5}$ historical concentrations at Pinehurst, Idaho, 2007–2016.

Figure 37 shows the PM_{10} concentrations measured at Pinehurst during July through September for 2007 through 2016. Data are shown only for the period spanning a typical fire season because other seasons may see elevated concentrations due to other factors like woodstove emissions or wintertime inversions. The 10-year data set shows that most values remain below 50 µg/m^3

during the fire season, with periodic excursions up to 200 μg/m^3. An outlier from the 2007 fire season reached 318 μg/m^3.

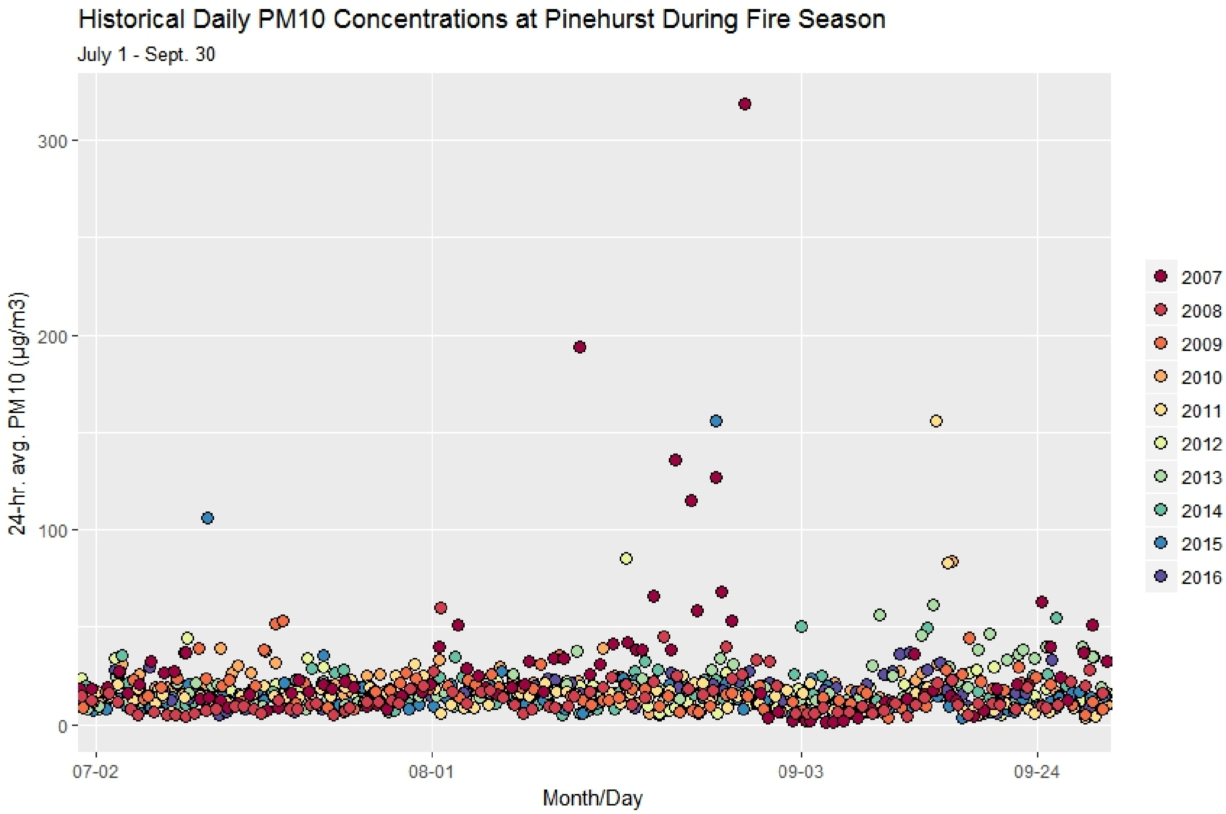


Figure 37. PM_{10} historical concentrations at Pinehurst, Idaho, 2007–2016.

Table 2 presents the statistics for $PM_{2.5}$ and PM_{10} concentrations measured during the fire season from 2007–2016 and separately for 2017. For $PM_{2.5}$, all statistics are higher for the 2017 season compared to the historical seasons; 2017 was an exceptional year for $PM_{2.5}$ impacts due to wildfire. For PM_{10}, the summary statistics do not indicate that 2017 had greater impacts than the historical seasons. Figure 37 reveals that the 2007 fire season had a handful of high values. In general, the PM_{10} summary values are quite close and reflect the recurring nature of wildfires in Idaho.

Table 2. Statistics for 24-hour $PM_{2.5}$ and PM_{10} concentrations recorded at Pinehurst during the wildfire season in 2007–2016 and 2017.

	$PM_{2.5}$ (µg/m^3)		PM_{10} (µg/m^3)	
Statistic	**2007–2016**	**2017**	**2007–2016**	**2017**
Minimum	0.2	1.5	1.0	1.0
Maximum	108.5	222.2	318.0	169.6
Median	6.0	8.2	15.0	12.0
Mean	8.2	14.2	18.5	15.5
Standard deviation	8.4	19.8	18.2	16.4

Figure 38 shows the $PM_{2.5}$ concentrations during the 2017 fire season compared to concentrations during the historical period, 2007–2016. The 95th percentile and mean concentrations of the historical years are plotted as solid and dashed lines, respectively. Stars denote the 2017 event year concentrations. The five days requested for 2017 are the highest recorded at Pinehurst during the past 11 fire seasons.

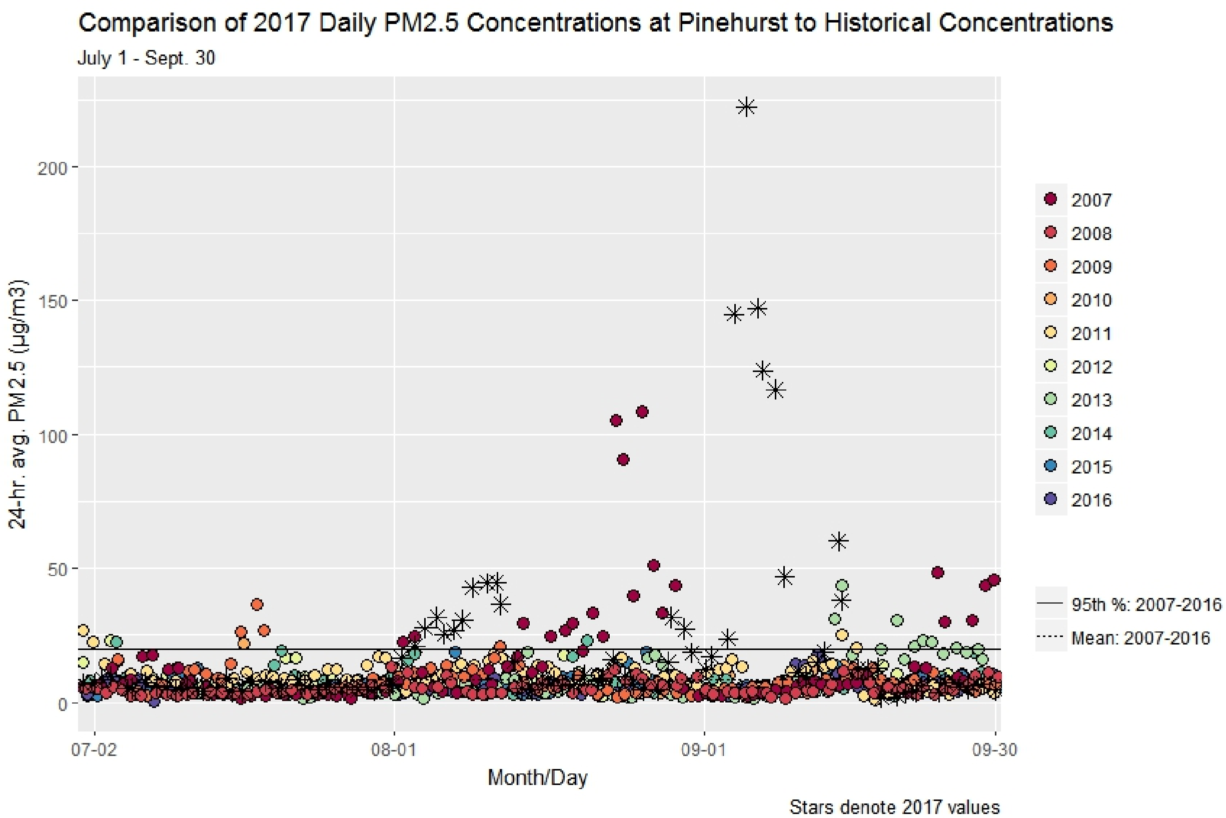


Figure 38. $PM_{2.5}$ concentrations during the 2017 wildfire season compared to previous years.

Figure 39 shows the PM_{10} concentrations during the 2017 fire season compared to concentrations during the historical period, 2007–2016. All 2017 days are well within the typical range of concentrations represented by the historical data except for three high values that occurred in early September. DEQ is requesting exclusion for these three values. Each of the requested concentrations is well above the historical 95th percentile and is within the top eight highest concentrations recorded at Pinehurst during the past 11 fire seasons.

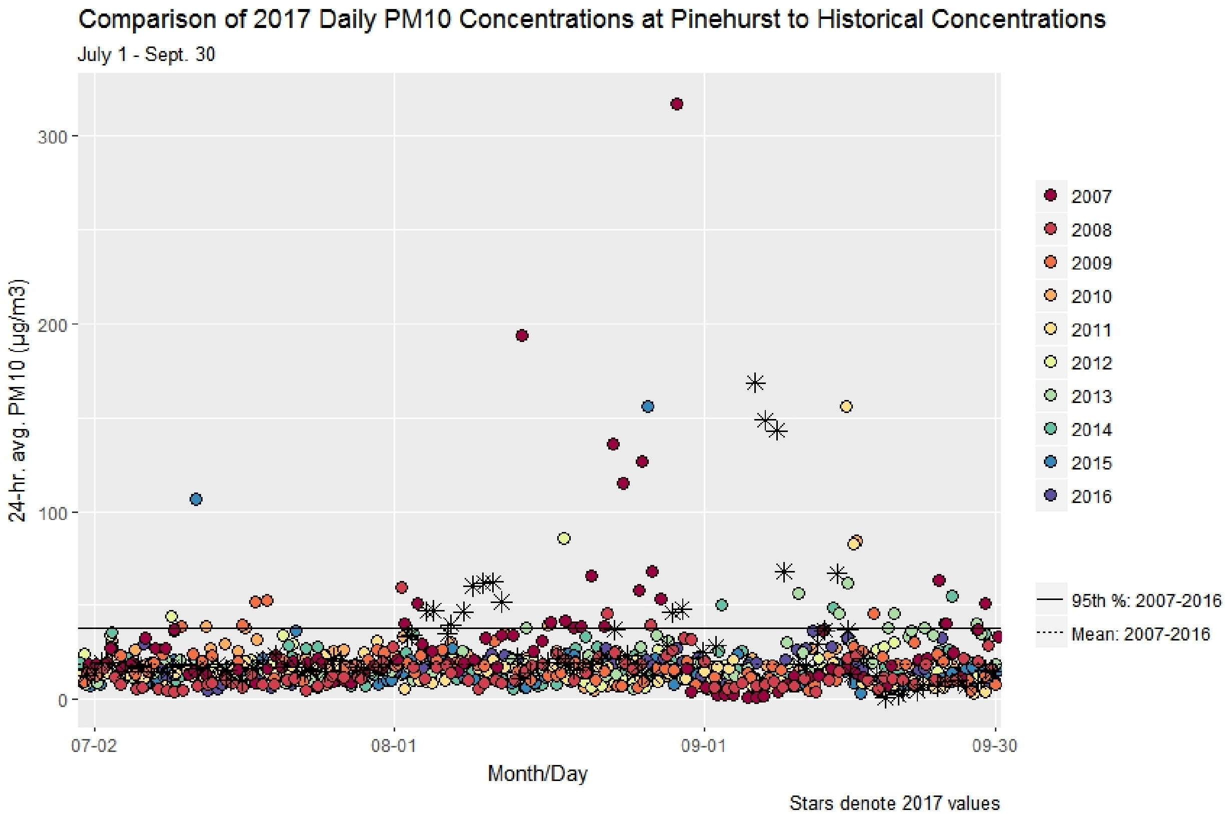


Figure 39. PM_{10} concentrations during the 2017 wildfire season compared to previous years.

4 Not Reasonably Controllable or Preventable

This EER element requires a demonstration that the event was neither reasonably controllable nor preventable, and this requirement has been met for wildfire events (40 CFR 50.14(b)(4)). DEQ presents sufficient evidence in this demonstration showing the source of the event was indeed wildfires (section 1, section 2). DEQ contends that the event of September 4–8, 2017, at Pinehurst was both not reasonably controllable or preventable.

5 Human Activity Unlikely to Recur at a Particular Location or a Natural Event

The EER requires a demonstration that the event was a human activity unlikely to recur at a particular location or was a natural event. Wildfires that predominantly occur on wildland are defined in the rule as natural events. DEQ presents data in sections 1 and 2 describing the source of the event as wildfires burning in Idaho, Montana, Oregon, Washington, British Columbia, and Alberta. DEQ provides further information showing that no CRB or prescribed fires took place during the event (Figure 35, section 2.7.2). This evidence satisfies the human activity unlikely to recur at a particular location or a natural event criterion.

6 Mitigation

The EER requires states to take appropriate and reasonable actions to protect public health from exceedances or violations of the NAAQS (40 CFR 51.930). DEQ presents evidence of prompt public notification of the event, public education so that individuals could make behavioral changes to reduce exposure to unhealthy air, and implementation of appropriate measures to protect public health from the impacts of exceptional events.

DEQ's wildfire season mitigation efforts are set forth in the *Idaho Wildfire Smoke Event Response Protocol*, an internal document updated annually. The document identifies interagency coordination during wildfire events, key actions to undertake during an event, and the air quality triggers for agency actions. The protocol also outlines public outreach efforts and lists resources and references for use in public education and implementation of measures to protect public health.

6.1 Public Notification

DEQ monitors ambient air quality and provides an air quality forecast to the public daily. During significant smoke events, DEQ may deploy portable emergency $PM_{2.5}$ monitors to supplement the existing network to track air quality in communities receiving the heaviest impacts. The air quality forecast, presented as values on the AQI, provides advance notice of possible smoke movement and impact. During the wildfire season, the regular air quality forecast is supplemented with a daily wildfire smoke forecast that provides additional information on weather, smoke movement, and fire activity. DEQ also works closely with schools to provide them with up-to-date air quality information and recommendations on whether to limit or cancel recess or athletic events.

6.2 Public Education

Along with the Idaho Division of Public Health, DEQ communicates health warnings and recommendations to the public through the Idaho Smoke Blog (*idsmoke.blogspot.com/*). Through this public website, DEQ and the Idaho Division of Public Health inform the public of current air quality conditions with AQI maps, links to state, tribal, and federal monitoring networks, and webcams showing current conditions. For those citizens interested in the sources of smoke, an entire section of the blog provides links to federal firefighting agencies, wildfire tracking sites, and locations to view satellite data of wildfire smoke and fire detections. An additional section contains fact sheets and information about the health effects of smoke and how to reduce personal exposure.

DEQ also uses social media to notify the public when wildfire smoke impacts air quality in Idaho. Through Facebook (*www.facebook.com/IdahoDEQ*) and Twitter (*www.twitter.com/IdahoDEQ*), the agency posts information about air quality alerts, health, and outdoor burning. The Daily Air Quality Reports and Forecasts webpage on DEQ's website (*www.deq.idaho.gov/daily-air-quality-reports-forecasts*) allows citizens to view a 3-day air quality forecast, AQI values, health concerns, burning information, and special messages from regional offices on their desktop computer or mobile device. Citizens can also sign up to receive daily air quality forecast emails through EPA's EnviroFlash service.

6.3 Implementation of Measures to Protect Public Health

Based on daily monitoring of ambient air quality, DEQ determines if health standards are being or will be exceeded. The agency issues notifications to the public and news media based on our emergency rule authority. Implementing this rule requires notification of specific health messaging and triggers enforceable open burning cessation requirements. When the air quality reaches the Unhealthy for Sensitive Groups category for part of the day or is forecast to remain or deteriorate for the next 24 to 72 hours, DEQ initiates interagency conference calls with federal, tribal, and state health agencies to share information and coordinate health messaging to the public. DEQ also relies on *Wildfire Smoke: A Guide for Public Health Officials* (EPA et al. 2016) and the *Montana-Idaho Interagency Smoke Management Coordination Strategy* (BLM et al. 2015) to steer health messaging decisions.

7 Initial Notification

Figure 40 shows the email from EPA to DEQ, which provides evidence that DEQ held a call with EPA Region 10 to fulfill the Initial Notification Requirements in the EER (40 CFR 50.14(c)(2)).

From: Spenillo, Justin <Spenillo.Justin@epa.gov> Sent: Thu 2/1/2018 1:47 PM
To: Sara Strachan; Mary Anderson
Cc: Jentgen, Matthew; Kotchenruther, Robert
Subject: Initial Notification Call - Cache and WSV 2017

Sara / Mary,

Thanks for the call today to discuss preparing Exceptional Event 2017 $PM_{2.5}$ Wildfire demonstrations for the Cache Valley and West Silver Valley nonattainment areas in Idaho. These events have regulatory significance as per the 2016 EER and our call today will serve as meeting the Initial Notification requirements (we typically refer to the annual meeting generally).

As always, we are happy to review drafts and answer questions as you develop these demonstrations.

Justin / Matt / Bob

Justin Spenillo | Fine Particulate Matter ($PM_{2.5}$)
Air Planning Unit | Office of Air and Waste
U.S. EPA Region 10 | Seattle, WA
(206) 553-6125 | spenillo.justin@epa.gov

Figure 40. Email from EPA to DEQ indicating initial notification compliance with the EER.

8 Public Comments

Proof of Publication

AFFIDAVIT OF PUBLICATION

STATE OF IDAHO, } ss.
County of Shoshone

Geri Hagler being first duly sworn upon oath deposes and says:

1. I am now and at all times hereinafter mentioned was a citizen of the United States, resident of the State of Idaho, over the age of twenty-one years and not a party of the above entitled action.

2. I am now and at all times hereinafter mentioned was the printer (principal clerk) of the "Shoshone News Press", a newspaper printed and published daily except Sunday and Monday in Kellogg, Shoshone County, Idaho, and having a general circulation in said county.

3. The legal notice

of which the annexed is a printed copy, was published in the regular Wednesday issue of said newspaper for ~~consecutive~~ day commencing on the 4 day of July, 2018 and such publication was made as often during said period as said bi weekly newspaper was regularly issued.

4. That said newspaper has been continuously and uninterruptedly published in said Shoshone County, during a period of more then seventy-eight consecutive weeks immediately prior to the first publication of said notice. Geri Hagler

On this 4 day of July in the year of 2018 before me, a Notary Public, personally appeared Geri Hagler, known or identified to me to be the person whose name subscribed to the within instrument, and being by me first duly sworn, declared that the statements therein are true, and acknowledged to me that he executed the same.

Katrina George
Notary Public for the State of Idaho
residing in Coeur d'Alene, Idaho

KATRINA GEORGE
NOTARY PUBLIC
STATE OF IDAHO

MY COMMISSION EXPIRES 8/29/23

PUBLIC NOTICE
NOTICE OF 30-DAY PUBLIC COMMENT PERIOD ON REQUEST TO EXCLUDE SEVERAL DAYS OF AIR QUALITY DATA FROM PM2.5 and PM10 NAAQS CALCULATIONS FOR PINEHURST, IDAHO.

PROPOSED ACTION: The Idaho Department of Environmental Quality (DEQ) is requesting concurrence from the US Environmental Protection Agency to exclude high concentrations of particulate matter, both fine particulate (PM2.5) and coarse particulate (PM10) recorded during the 2017 wildfire season in Pinehurst from calculations used to designate attainment status with the National Ambient Air Quality Standard (NAAQS).
The report "Exceptional Events Demonstration Requesting Exclusion of PM2.5 and PM10 Monitor Values Impacted by Wildfires at Pinehurst, Idaho, in 2017" demonstrates how these flagged days comply with the federal Exceptional Events Rule (40 CFR 50 and 51 [81 FR 68216]) promulgated on October 3, 2016. The rule allows states to flag air quality data as exceptional and exclude those data from use in determining compliance with the NAAQS due to events that are not reasonably controllable or preventable - pending EPA concurrence.
BACKGROUND: Portions of Shoshone County, Idaho, were designated as the West Silver Valley PM2.5 nonattainment area (WSV NAA) in 2015 (40 CFR 81), with an attainment date of December 31, 2021. However, on March 10, 2017, Idaho requested EPA make a Determination of Clean Data for the WSV NAA. EPA has not acted on this request. Monitor values during the 2017 wildfire season that meet the criteria for exceptional events must be excluded for the Clean Data Determination.
Portions of Shoshone County, Idaho are also currently designated as nonattainment for the 24-hour PM10 NAAQS. On September 29, 2017, Idaho submitted a "PM10 Limited Maintenance Plan and Request for Redesignation of the Pinehurst PM10 Nonattainment Area and Pinehurst Expansion PM10 Nonattainment Area in Idaho." An evaluation of the 24-hour 3-year (2015-2017) PM10 design value for the Pinehurst monitors with and without the requested exceptional event days shows that one day requires exclusion to ensure compliance with the NAAQS. Two additional days are requested to maintain compliance with the 24-hour limited maintenance plan criteria.
PUBLIC COMMENT: The public comment period will last from July 5 to August 6, 2018. Questions regarding the public comment process should be directed to:
Tanya Chin, Department of Environmental Quality, 1410 N. Hilton, Boise, ID 83706, tanya.chin@deq.idaho.gov , or 208-373-0440.
AVAILABILITY OF MATERIALS: The document "Exceptional Events Demonstration Requesting Exclusion of PM2.5 and PM10 Monitor Values Impacted by Wildfires at Pinehurst, Idaho, in 2017" is available for public review on DEQ's website at http://www.deq.idaho.gov/news-public-comments-events/
Printed materials will be made available upon request at the DEQ state office.
SUBMISSION OF WRITTEN COMMENTS-ASSISTANCE ON TECHNICAL QUESTIONS: Anyone may submit written comments regarding the document. To be most effective, comments should address air quality considerations and include support materials where available. All comments should be directed to Tanya Chin, Department of Environmental Quality, 1410 N Hilton, Boise, ID 83706-1255,
tanya.chin@deq.idaho.gov , or 208-373-0440.
Please reference the document title listed above when sending comments or requesting information
For technical assistance on questions concerning this document, please contact Mary Anderson at (208) 373-0202 or Mary.Anderson@deq.idaho.gov.
All written comments concerning this document must be directed to and received by the undersigned on or before 5:00 p.m., MST/MDT, August 6, 2018.
DATED this 4th of July.
Tanya Chin
Air Quality Division
SHO LEGAL 2927
AD#204711
JULY 4, 2018

(b) (6) Public Comment, Pinehurst, 07/10/2018

Name:

(b) (6)

Email:

(b) (6)

Affiliation:

Comments:

Minor comments, suggestions, and questions:

DEFINITIONS, ADDITIONS:
1. BSMP, CFR, oF, HRRR, HYSPLIT, ID, IDEA MT, OR, PDT, RWC, WA

DEFINITIONS, footnote 1, footnote 2, Introduction 1st paragraph.
2. Revise the definition of PM2.5 to “atmospheric particulate matter (PM) that has an aerodynamic diameter of 2.5 micrometers or less”
3. Revise the definition of PM10 to “atmospheric particulate matter that has an aerodynamic diameter of 10 micrometers or less”

EXECUTIVE SUMMARY
4. 1st paragraph: The U.S. Environmental Protection Agency (EPA) promulgated the Exceptional Events Rule (EER) pursuant to Section 319 of the Clean Air Act. Major changes to the 2007 EER contained in the Code of Federal Regulations, Title 40, Parts 50 and 51 (40 CFR 50 and 51) were promulgated on October 3, 2016 (72 FR 13560) to clarify the scope of the rule; analyses, content, and organization for exceptional events demonstrations; and fire-related definitions and demonstration components.
5. Last sentence: Replace “EER rule (Table D)” with “EER (Table D)”
6. Table D. Section 7 covers the Initial Notification, Public Comments and DEQ Responses are in Section 8.

1 CONCEPTUAL MODEL
7. Replace “smoke in place for 5 days” with “smoke in place for five days”

1.4 EMISSIONS
8. Anthropogenic emissions were taken from the 2014 NEI, described as being from a “typical” year. How was it determined that this was a typical year, particularly with regard to prescribed burning emissions? Or, were NEI 2014 data used because they represent the most recent available data for these emissions?
9. Page 9, paragraph just below Figure 7. Spell out state names for WA, OR, ID, and MT.

1.5 MONITOR IMPACT
10. Replace “Very Unhealthy categories for 2 or more days” with “Very Unhealthy categories for two or more days”

11. Paragraph just below Figure 9, replace “Pacific Daylight Time” with “Pacific Daylight Time (PDT)”

1.6 SUMMARY
12. Replace “causing exceedances of the annual and 24-hr NAAQS on September 4, 5, 6, 7, and 8, 2017” with “causing exceedances of the 24-hr PM2.5 NAAQS on September 4-8, 2017; exceedance of the annual PM2.5 NAAQS; and exceedances of the 24-hr LMP criterion and 24-hr NAAQS for PM10 on September 6-8, 2017”

2.1.2 SATELLITE DATA AND BACK TRAJECTORIES
13. Define Zulu time in the first paragraph on page 17.
14. Back trajectories were run for the 24-hr period ending at midnight local time?

2.2.3 TIME SERIES EVIDENCE: TEMPORAL DESCRIPTION OF EVENT DAY
15. Clarify that times are PDT
16. Replace “2 miles per hour (mph)” with “2 miles per hour (mph, or 1.74 kt)”

2.3.3 TIME SERIES EVIDENCE: TEMPORAL DESCRIPTION OF EVENT DAY
17. Clarify that times are PDT

2.4.3 TIME SERIES EVIDENCE: TEMPORAL DESCRIPTION OF EVENT DAY
18. Paragraph just below Figure 26, replace”1.4 mph” with “1.4 mph (1.22 kt)”

2.5.3 TIME SERIES EVIDENCE: TEMPORAL DESCRIPTION OF EVENT DAY
19. Clarify that times are PDT
20. Paragraph just below Figure 28, replace “2 mph” with “2 mph (1.74 kt)”

2.6.3 TIME SERIES EVIDENCE: TEMPORAL DESCRIPTION OF EVENT DAY
21. Clarify that times are PDT
22. Paragraph just below Figure 33, replace “3 mph” with “3 mph (2.61 kt)”

2.5 AALTERNATIVE SOURCE HYPOTHESES
23. Replace “residential wood combustion” with “residential wood combustion (RWC)”

2.5.3 RESIDENTIAL WOOD COMBUSTION
24. Two instances, replace “residential wood combustion” with “RWC”
25. Replace “oF” with “degrees Fahrenheit (oF)”

2.5.4 OPEN BURNING
26. Replace “all of nonpoint is” with “all of the nonpoint source emissions are”

3 HISTORICAL CONCENTRATIONS
27. Paragraph just below Table 2, replace “The 5 days requested for 2017 are the highest recorded during the past 11 fire seasons at Pinehurst” with “The five days requested for 2017 are the highest recorded at Pinehurst during the past 11 fire seasons”
28. Paragraph just below Figure 38, replace “are within the top eight highest

concentrations recorded during the past 11 fire seasons at Pinehurst" with "is within the top eight highest concentrations recorded at Pinehurst during the past 11 fire seasons"

4 NOT REASONABLY CONTROLLABLE OR PREVENTABLE
29. Replace "The EER element" with "This EER element"
30. Replace "was both not reasonably controllable or preventable" with "was neither reasonably controllable nor preventable"

REFERENCES CITED
31. Not defined: BLM, NPSP, USFWS, BIA, MT DNRC, MTDEQ, NCEP/NCAR

Thank you:

Exceptional Event Pinehurst Response to Comments 2017, $PM_{2.5}$ and PM_{10}

DEQ's Response to Comments
Exceptional Events Demonstration Pinehurst, ID 2017

Commenter 1 – (b) (6)		

Note. A minor discrepancy between Tables A and C was discovered during the public comment process (values were different by a fraction of 1 $\mu g/m^3$). The values in Table A were determined to be correct. The inconsistencies in Table C were corrected. This minor correction did not alter any of the analysis.

Commenter	Comment	Response
1	DEFINITIONS, ADDITIONS: 1. BSMP, CFR, oF, HRRR, HYSPLIT, ID, IDEA MT, OR, PDT, RWC, WA	1. Text was revised
1	DEFINITIONS, footnote 1, footnote 2, Introduction 1st paragraph. 2. Revise the definition of PM2.5 to "atmospheric particulate matter (PM) that has an aerodynamic diameter of 2.5 micrometers or less" 3. Revise the definition of PM10 to "atmospheric particulate matter that has an aerodynamic diameter of 10 micrometers or less"	2. Text was revised. 3. Text was revised.
1	EXECUTIVE SUMMARY 4. 1st paragraph: The U.S. Environmental Protection Agency (EPA) promulgated the Exceptional Events Rule (EER) pursuant to Section 319 of the Clean Air Act. Major changes to the 2007 EER contained in the Code of Federal Regulations, Title 40, Parts 50 and 51 (40 CFR 50 and 51) were promulgated on October 3, 2016 (72 FR 13560) to clarify the scope of the rule; analyses, content, and organization for exceptional events demonstrations; and fire-related definitions and demonstration components. 5. Last sentence: Replace "EER rule (Table D)" with "EER (Table D)" 6. Table D. Section 7 covers the Initial Notification, Public Comments and DEQ Responses are in Section 8.	4. Text was revised. 5. Text was revised. 6. Text was revised.
1	1 CONCEPTUAL MODEL 7. Replace "smoke in place for 5 days" with "smoke in place for five days"	7. Text was revised.

Commenter	Comment	Response
1	1.4 EMISSIONS 8. Anthropogenic emissions were taken from the 2014 NEI, described as being from a "typical" year. How was it determined that this was a typical year, particularly with regard to prescribed burning emissions? Or, were NEI 2014 data used because they represent the most recent available data for these emissions? 9. Page 9, paragraph just below Figure 7. Spell out state names for WA, OR, ID, and MT	8. The NEI 2014 is the best and most recent data available for non-wildfires. Clarification was added to Section 1.4. 9. State names were spelled out on Page 1 section 1.1.
1	1.5 MONITOR IMPACT 10. Replace "Very Unhealthy categories for 2 or more days" with "Very Unhealthy categories for two or more days" 11. Paragraph just below Figure 9, replace "Pacific Daylight Time" with "Pacific Daylight Time (PDT	10. Text was revised. 11. Text was revised.
1	1.6 SUMMARY 12. Replace "causing exceedances of the annual and 24-hr NAAQS on September 4, 5, 6, 7, and 8, 2017" with "causing exceedances of the 24-hr PM2.5 NAAQS on September 4-8, 2017; exceedance of the annual PM2.5 NAAQS; and exceedances of the 24-hr LMP criterion and 24-hr NAAQS for PM10 on September 6-8, 2017"	12. Text was revised
1	2.1.2 SATELLITE DATA AND BACK TRAJECTORIES 13. Define Zulu time in the first paragraph on page 17. 14. Back trajectories were run for the 24-hr period ending at midnight local time?	13. Text was revised. 14 Correct. Clarification was added to section 2.1.2.
1	2.2.3 TIME SERIES EVIDENCE: TEMPORAL DESCRIPTION OF EVENT DAY 15. Clarify that times are PDT 16. Replace "2 miles per hour (mph)" with "2 miles per hour (mph, or 1.74 kt)"	15. Text was revised. 16. Text was revised.
1	2.3.3 TIME SERIES EVIDENCE: TEMPORAL DESCRIPTION OF EVENT DAY 17. Clarify that times are PDT	17. Text was revised.
1	2.4.3 TIME SERIES EVIDENCE: TEMPORAL DESCRIPTION OF EVENT DAY 18. Paragraph just below Figure 26, replace"1.4 mph" with "1.4 mph (1.22 kt)"	18. Text was revised.

Commenter	Comment	Response
1	2.5.3 TIME SERIES EVIDENCE: TEMPORAL DESCRIPTION OF EVENT DAY 19. Clarify that times are PDT 20. Paragraph just below Figure 28, replace “2 mph” with “2 mph (1.74 kt)”	19 Text was revised. 20 Text was revised.
1	2.6.3 TIME SERIES EVIDENCE: TEMPORAL DESCRIPTION OF EVENT DAY 21. Clarify that times are PDT 22. Paragraph just below Figure 33, replace “3 mph” with “3 mph (2.61 kt)”	21. Text was revised. 22. Text was revised.
1	2.5 AALTERNATIVE SOURCE HYPOTHESES 23. Replace “residential wood combustion” with “residential wood combustion (RWC)”	23. Text was revised.
1	2.5.3 RESIDENTIAL WOOD COMBUSTION 24. Two instances, replace “residential wood combustion” with “RWC” 25. Replace “oF” with “degrees Fahrenheit (oF)”	24. Text was revised. 25. Text was revised.
1	2.5.4 OPEN BURNING 26. Replace “all of nonpoint is” with “all of the nonpoint source emissions are”	26. Text was revised.
1	3 HISTORICAL CONCENTRATIONS 27. Paragraph just below Table 2, replace “The 5 days requested for 2017 are the highest recorded during the past 11 fire seasons at Pinehurst” with “The five days requested for 2017 are the highest recorded at Pinehurst during the past 11 fire seasons” 28. Paragraph just below Figure 38, replace “are within the top eight highest concentrations recorded during the past 11 fire seasons at Pinehurst” with “is within the top eight highest concentrations recorded at Pinehurst during the past 11 fire seasons”	27 Text was revised. 28. Text was revised.
1	4 NOT REASONABLY CONTROLLABLE OR PREVENTABLE 29. Replace “The EER element” with “This EER element” 30. Replace “was both not reasonably controllable or preventable” with “was neither reasonably controllable nor preventable”	29. Text was revised. 30. Text was revised.
1	REFERENCES CITED 31. Not defined: BLM, NPSP, USFWS, BIA, MT DNRC, MTDEQ, NCEP/NCAR	31 In order to make the reference readable, we only included the acronyms. Each agency is spelled out in the document that can be accessed via the web link included.

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